Concrete

Vol. 28 Chicago, January, 1926 No. 1

What Does a Road Engineer Think About?

CONCRETE'S Annual Symposium with Contributions by John N. Mackall, Charles M. Upham, C. R. Ege, W. E. B. Roberts, Robert M. Morton, B. H. Piepmeier, G. F. Schlesinger, W. W. Lane, George B. Shaffer, George H. Henderson, Roy A. Klein, W. W. Zass, and an Anonymous State Highway Engineer.

"What thoughts are uppermost in your mind about concrete road development—either as to design or construction progress made or looked for?"

That question was put to a select list of highway engineers and the thirteen replies published here seem to cover concrete road development in a geographical sense—from Atlantic to Pacific, South, North and Middle States—and in a technical and construction sense as well.

Five of the contributors to this symposium put stress on mix control.

It is rather interesting that three put emphasis on the importance of earlier strength and therefore earlier opening to traffic—either through richer mixes, less water, better curing conditions or the use of accelerators or special cements.

Two are interested in better transverse joints, two in surface perfection, one in wider roads, one in better subgrade and two especially in matters involving research as to reinforcing and a measure of pavement value.—Editors.

Smooth Surface Greatest Asset

By JOHN N. MACKALL

Chairman Maryland State Roads Commission

We are convinced that smoothness is the greatest asset to a concrete road. We believe that a great deal of thought and effort have been given to the finish of concrete roads without, however, concentrating upon the smooth finish in the final analysis. We believe that the life of a concrete road is dependent conversely upon the amount of impact it gets from trucks. The problem is to make the truck tires roll along the surface of the road instead of bumping from one point to another.

The hand tampers, the machine tampers and every other method of tampers seem not at all to take into consideration the smoothness of the concrete road. All kinds of screeds have been used after the concrete has been tamped, but it is our experience that a concrete road once tamped unevenly will always present an uneven surface. It is our judgment that the greatest step forward which has been made in hand finishing and in machine finishing is the substitution of the screed for the tamper. If you will take concrete uniformly proportioned, uniformly mixed, placed between forms set to line and grade and struck religiously to the grade of the forms and then do the minimum work to destroy the cross section, you will have a concrete road of the maximum usefulness.

Most Important Development a Smoother Surface

By CHARLES M. UPHAM

North Carolina State Highway Engineer

The past year has without doubt been one of the best construction seasons we have ever had in North Carolina. We have made many developments in concrete road construction, and probably the most important one is that of obtaining a smoother surface.

The contractors have tried out several new devices for the handling of materials that have assisted in the progress of construction. I think next year will record a closer control of concrete aggregates, either by weight or volume, with a possible attempt at controlling the percentage of the various sized aggregates.

I also feel now that the investigation on the reinforcing of concrete pavement has been completed that there will be a more defined method of design in regard to this detail of construction. In addition to this, of course, the improved machinery will have its effect, and we can look forward to a reasonable progress, the same which has been experienced during the past year.

Wider Roads—Early Strengths for Quick Use

By C. R. EGE

Manager Highways Bureau, Portland Cement Association

The outstanding development of 1925 in road construction is the use of increased widths of pavement. This has been forced by the increase in volume of traffic, rather than the weight of the traffic units. It is realized that if we are to have the efficiency of motor vehicle service, it will be real economy to provide pavements of such width that the normal traffic flow will never be interrupted. In addition there must be reasonable provision for the regular peak loads, some reserve capacity for abnormal traffic movements upon unusual occasions. These requirements have forced pavement construction to widths of as much as 44 feet, and, in at least one case, double roadways of this width.

There is now much interest in the early strength of concrete. It is often necessary to turn traffic over a pavement within a few days after construction. It is found possible to produce concrete having a compressive strength of 2,500 pounds at three days. This is economically accomplished with standard portland cements, by limiting the ratio of mixing water to cement, by use of rich mixtures, by lengthening the mixing period, and by doing the work when favorable air temperatures are maintained. The possibilities and limitations of admixtures of calcium chloride have been studied extensively; and there is now sufficient definite information available to enable a paving engineer to utilize this material intelligently. It is possible to apply these methods to repair work, so that a satisfactory patch of limited area can be opened to traffic in twenty-four hours after placing.

There have been few new developments in pavement design or construction equipment during the year past; but the principles brought out by the Bureau of Public Roads and by Clifford Older have been proven by the satisfactory service of the roads built since 1922.

Concrete pavements completed during ten months of 1925 to November 1 totaled more than 94,000,000 square yards. Final reports for the entire year are not available as this is written, but it is evident that the record of 1924 will be exceeded. The total of new contracts awarded during the year will for the first time in history go considerably over 100,000,000 square yards. More than a third of this total is municipal work—concrete streets and alleys. The increasing use of concrete for street paving reflects the growing conviction of municipal engineers that modern traffic requires a heavy, rigid slab whose surface will remain true to grade and resist displacement under solid tires.

At this time it seems evident that 1926 will see a continued large volume of concrete pavement construction, probably exceeding the new record of 1925 which has now become history.

How Shall We Measure Pavement Value?

By W. B. ROBERT
Louisiana State Highway Engineer

It is my opinion that the development most needed at this time is research work to establish a definite and conclusive measurement of the value of any given concrete pavement. In other words, opinion should be crystallized as to whether the compressive strength or the tenstile strength of the pavement slab is the ruling factor in determining the load carrying value of the pavement and its resistance to traffic.

I believe that any influence tending to establish a definite measure of the value of the several elements entering into the construction of concrete pavement is to be encouraged, and that this work, if intelligently carried forward, will be of inestimable value to all commercial and recreational interests.

Better Mix Control—Better Joints—Quicker Use of Pavement

By ROBERT M. MORTON
California State Highway Engineer

The most notable achievement in California's highways has been through a more close control of the aggregate, grading and water content, to greatly increase the strength of the concrete. We are obtaining minimum strength of 3,500 lbs. on 28 day tests, and most of the jobs exceed 4,000 lbs. average. Occasional jobs where the best local materials are available average above 5,000 lbs. We use six sacks of cement per cubic yard.

All of the materials in our mixes are carefully tested and screened. We are separating our coarse aggregates into two sizes and are beginning to proportion by weight rather than by volume. We make allowance for the water contained in the sand and rock, and for the amount of bulking in the sand caused by moisture, and bring to the job the necessary sizes to sweeten up either the rock or sand. No increase in cost has been noticed with this additional care.

We are improving our joint construction. We have had best success with longitudinal joints by deep marking of the fresh concrete, rather than inserting a metal or other type of joint material. Our 20 foot width pavements are built in two seperate slabs with thickened sections both center and sides. We are no longer bothered with longitudinal cracking, and are making attempts to control the contraction cracks in two ways: (a) By the spreading of sand on the subgrade which reduces the coefficient of friction. Also it makes possible a perfect subgrade and reduces the contractor's over-run and other uncertainties. (b) By placing joints every 50 feet. Our latest development in this is either to use a poured joint ¾ inch in width with slip dowels or an elastic joint of ½ inch with dowels. The poured joint is made larger on account of difficulty in making an open joint too small.

Our 1926 work will probably be cured for a less time than previously. Heretofore we have cured for 14 days under water, and on the basis of elaborate tests made in our laboratory we will make the time not more than 10 days. This will somewhat decrease the cost. We are also considering the opening of pavements in 14 rather than 21 days.

Need Better Control of the Mix

By B. H. PIEPMEIER
Chief Engineer Missouri State Highway Department

In Missouri we have, during the past three or four years, raised the standard of the quality of aggregates entering concrete. Most cement companies have raised the standard of cement. Greater attention, therefore, should be given to field operations so that a better concrete may be secured.

The time of mixing concrete may well be increased or the efficiency of the concrete mixers may be standardized or increased to insure a better concrete.

Much can yet be done towards securing a uniform consistency of mixed concrete. It is hoped that some one will design a practical device that will control the consistency of mechanical means. Uniform consistency will insure much more uniform strength of pavement and a much smoother riding surface. Concrete of uniform consistency can be finished to a much truer surface, and in this way meet the demands of the traveling public.

Need Knowledge of Reinforcing—Effect of Impact—Methods for Uniformity

By G. F. SCHLESINGER
Director of Highways and Public Works for Ohio

Progress in the art of concrete road construction in the last few years has been very great indeed due to a number of investigations on the part of various state highway departments, the Federal Bureau of Public Roads and interested commercial agencies.

The design of concrete roads has now been placed on what approaches a rational basis. The use of the thickened edge cross section with the center longitudinal joint has been a great step in advance and will result not only in better design but also in economy of cost.

In regard to the preparation of concrete our knowledge of the harmful effect of excess water and the importance of the ratio of cement to water has been very helpful in securing a better quality of concrete. Other important facts that have been discovered are the effect of moisture in causing sand to bulk and the consequent development of more accurate methods of measuring aggregates including the weight and inundation methods. It has only been in recent years that engineers have required that the concrete be properly cured. Most highway departments are securing better surface finishing by checking up the finished product with profilometer machines of various types. The wide practice of testing the thickness of concrete pavements by cutting cores from the slab has also resulted in better and more honest construction. Another innovation that has been introduced recently is the quick hardening early strength cement which can frequently be used to advantage both in construction and in repair.

In regard to the future, some positive knowledge of: The economic value of reinforcing in concrete; the advisability and the standardization of the use of transverse expansion joints; the effect of fatigue due to repeated temperature and load stresses and the development of more positive methods of securing uniform concrete, are, in my mind, very desirable. Also we need more knowledge of the effect of the type of subgrade upon the durability of pavements. All of these factors are now being investigated and, no doubt, continued research will result in a still greater improvement in our design and construction methods as applied to the concrete type of pavement.

Better Mix Control—Improved Joints

By W. W. LANE
Chief Engineer Arizona Highway Department

There are two very important factors for the future success of concrete roads: Control of aggregate, and the joint construction. The control of the aggregate is receiving much attention at this time through the weight process, and the sand inundation process. It is my opinion that the sand inundation process will be most generally adopted, as it has a greater range of control than the weight process alone.

The question of obtaining a perfect expansion joint has been one of much thought and concern, and as we have been experimenting with a type of joint in this State that has proven successful beyond all anticipation, I am attaching some data on it—a report on the joint written by George B. Shaffer, district engineer for this department, who has fostered the development of this joint.

Expansion Joints in Arizona

By GEORGE B. SHAFFER
District Engineer Arizona State Highway Department

Expansion joints in concrete paving construction are or should be considered from the standpoint of maintenance rather than merely a component part of the pavement. A pavement just completed sometimes furnishes an appearance of faultless construction and all those concerned are satisfied that the taxpayers have received a pavement that will last many years at a low cost of maintenance, but experience has proven that after the pavement has been subjected to traffic for a few years, the maintenance engineer and his crews are prone to say that the pavement was either improperly designed or improperly constructed and the designing and constructing engineers along with the human and mechanical elements which enter into the design and construction of the pavement are on trial for all failures. The engineer as a rule is a good loser and promptly offers a solution as a reward to the public an improvement in design and construction.

The expansion joint has long been the bug-bear of concrete paving construction and in some states was temporarily eliminated but is gradually coming back into use again as a necessary part of the pavement. The value of an expansion joint depends entirely upon its ability to properly function, and its ability to properly function depends upon its position in the finished pavement, assuming, however, that the thickness of the joint and the length of the interavls are of proper dimension. In Arizona the expansion interval is from 33 to 40 feet. The thickness of the expansion joint is from ¼ inch to ¾ inch, as a standard, although a small number have been of a greater thickness. More or less difficulty has been experienced with the narrower joint because of the fact that it cannot be readily removed for its full depth for replacement. It is found necessary to replace the entire joint in order to restore proper functioning of the joint. In case of the wider joints from ⅝ inch to 1¼ inch very little difficulty has been experienced in removing and replacing. The ¾ inch thickness of an expansion joint and the 40 foot interval may be varied slightly with equal success, but it does not insure a good joint unless properly placed in correct position and so maintained during construction. Many joints are properly spaced and of ample thickness but do not serve the purpose for which they were intended because they are out of position. This is not a guess as maintenance crews have continuously for a year been removing, enlarging, and correcting expansion joints near Phoenix and close examinations show conclusively that either insufficient or improperly constructed joints are responsible for nearly all of the blowouts, heaves and slipjoints. It is to be remembered, however, that the above mentioned joints have during years previous to the last twelve months been superficially maintained so as to not allow foreign material to enter which makes it reasonable to believe that the faults causing the failures date back to the time of construction. Some of the joints as constructed were not complete the two slabs being continuous under the partial joint, others were constructed at various angles with the profile of the pavement.

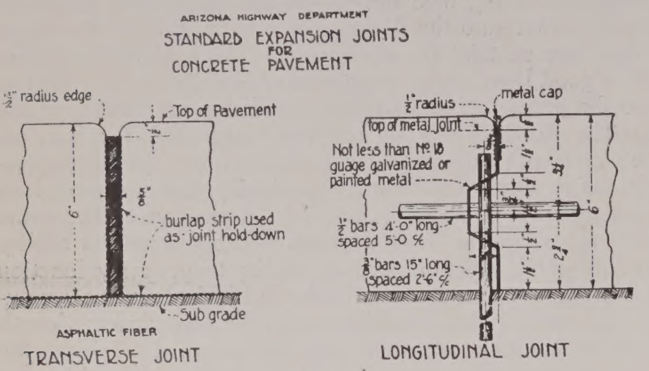
How to Hold the Joint in Place

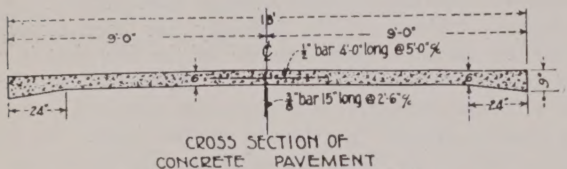
In the more recently constructed pavements in Arizona the following method of holding the joint in place has been used:

In an effort to overcome the difficulty in holding the joint in place the idea of using some kind of material placed over the joint material in a manner so that the concrete as it is brought up to either side will hold the joint material down in place rather than buoy it up as is commonly the case with usual methods.

Burlap was the material decided on for this purpose. It was ordered in strips the width being five to six times that of the joint material and cut in lengths equal to the width of the pavement. The strips of burlap were so placed over the joint material that they serve as a "hold-down" in the form of a blanket stirrup for the entire length of the joint. The strip is placed centrally over the top of the joint material and drawn down tightly on either side. The loose edges are then spread out flat upon the subgrade.

The accompanying detail cross-section of transverse joint shows this arrangement and the photograph was taken of a joint held in place ready to receive the general spread of concrete from the mixer.


ARIZONA HIGHWAY DEPARTMENT
STANDARD EXPANSION JOINTS FOR CONCRETE PAVEMENT
½" radius edge
Top of Pavement
6"
⅝"
burlap strip used as joint hold-down
Sub grade
ASPHALTIC FIBER
TRANSVERSE JOINT
½" radius
metal cap
top of metal joint
Not less than № 18 guage galvanized or painted metal
½" bars 4'-0" long spaced 5'-0 %
⅜" bars 15" long spaced 2'-6" %
6"
LONGITUDINAL JOINT



CROSS SECTION OF CONCRETE PAVEMENT THE (MARICOPA) ARIZONA SECTION

A small amount of concrete is placed on either side of the joint and tamped tightly against the sides. This avoids any slack forming in the burlap when the concrete is deposited about the joint. The finishing machine is allowed to pass over the joint one or more times before the header board is removed. The header board should be removed very slowly with one end slightly above the other and care being taken that the space under the header board is replaced by spading thoroughly while the removal is taking place.

Concrete Added

Concrete is now added to the extent of a surplus and the finishing machine is passed over as many times as are necessary to cut the surface to crown and grade. The entire surface has now been given the same tamping, rodding and belting process and is ready to receive whatever hand finishing that is necessary to even the surface. The submerged joint allows a free and continuous passage of the longitudinal float. The use of the longitudinal float is apparently the best assurance of an easy riding surface and its merits are most emphasized by its free and uninterrupted passage properly lapped over the entire surface of the run. The half inch of mortar which remains above the top of the joint is now removed and the slabs are edged on both sides of the joint.

This type of joint seems satisfactory. No defective joints have appeared where placed in this manner and for additional information cores were taken to show cross-section of joint. These cross-sections showed 100 per cent slab and 100 per cent joint in its proper position. The cores showed that the burlap did not allow concrete to pass under nor between the ends of the sections of the joint material, a very harmful condition which so often exists at expansion joints.

Attention to Subgrade—Use of Local Aggregates—Shorter Curing Period

By GEORGE H. HENDERSON

Chief Engineer Rhode Island State Board of Public Roads

We believe that concrete pavement construction is developing along proper lines, that a great deal of attention must be given to subgrade construction in certain localities if undue cracks and displacements are to be avoided.

We hope that the study in the use of materials will develop means which will permit the use of local aggregates now considered inferior and unfit for use in pavement construction.

We hope for developments in the use of quick-hardening cement or curing methods which will reduce the curing period of the finished pavement.

How Much Stone Should Go in the Pavement Mortar?

By A STATE HIGHWAY ENGINEER

There is really nothing new that occurs to us at the present time as being worthy of special mention along the line of design and construction of concrete pavements. However, there is a matter of the utmost importance affecting the entire engineering fraternity which we would like to discuss—the matter of proportioning materials for concrete paving work. As you know, there is a wide difference of opinion as to the proper amount of coarse aggregates to be incorporated in concrete for paving. A few of the states specify a mix of 1:2:4. A number of them are specifying 1:2:3½ and not a few are still clinging to the 1:2:3 proportion.

Apparently highway engineers are fairly well agreed on the mortar strength required to hold coarse aggregate in place, namely one part of cement to two parts of sand. The question is: "Is there anything in the way of tests that will prove that a state mixing in the proportion of 1:2:4 is getting a less economical pavement, or one that will not wear as well as adjoining states that are mixing their materials in the proportions of 1:2:3½ or 1:2:3?" Taking a mile of tangent 18 foot road in which there would be 10,560 square yards of surface, a 1:2:3½ mix would require 316 barrels of cement more than a 1:2:4, while a 1:2:3 mix would require 528 barrels more than the 1:2:4. Evidently someone is wasting money or some of the states are building roads that are not what they should be.

Geologists are fairly well agreed that the tensile strength of suitable coarse aggregate in the various states does not appreciably vary in their classification. It is generally agreed that the tensile strength of stone suitable for concrete paving work is greater than the tensile strength of 1:2 mortar. If this is true then the greater quantity of stone incorporated in the mix the greater the tensile strength of the slab will be, provided the concrete is dense and the voids entirely filled.

There is another phase of the matter which should be of vital concern and that is that due to the fact that there is such a wide variety of proportions in the several states the manufacturers of concrete pavers are at a loss to know how to standardize on drum sizes. A 21E paver that will handle a five sack batch of 1:2:4 concrete in Wisconsin is liable to be barred in a state mixing 1:2:3½ if the contractor attempts to use a six sack batch. If the several states in the Union would standardize on proportion, we believe it would be about as valuable a move for everyone concerned as could be made at this time.

(Concluded on page 37)

Comparing the State Methods

Every State Building Concrete Roads Is Striving for Better Work—Practices Differ on Many Points, as Do Opinions—A Comparative Symposium on Slab Design, Preparation of Subgrade, Pavement Width, Reinforcement, Proportioning by Weight, the Longitudinal Float, Water-Cement Ratio and Curing Methods

While paving some years ago might have been a hit-or-miss proposition in many states, it has now been put on the plane of a science. The increase in the number and weight of vehicles traveling over our trunk highways, together with rapidly mounting costs and freight rates on many important commodities, and the growing need for relieving the railroads of L. C. L. and short haul shipments, as well as the increasing need of the farmer for better haulage routes, have all had a part in making the modern concrete highway an economic necessity. The states have all had a common incentive in solving this great problem of automotive transportation, and all have based their programs and methods upon the estimated requirements of their own conditions, and have spent all available funds each year in such a way that essential highways might be well paved at the least cost. Because of prevailing high costs, both for construction and maintenance, of other types of hard roads, and because of the relative inability of some of them to carry modern and future traffic, the concrete road has been developed as the main type of pavement for all but unimportant work in many states. It was true, however, that in the beginning the permanent concrete road was more a matter of future possibilities and hopes than of actual fact. Better methods of design and construction had to be worked out in detail before the full possibilities of the material could actually be fully realized.

Our first concrete roads, in the main, were found to be imperfect because of a number of reasons. The main causes were, by some, considered to include poor workmanship, faulty design, unfit materials, inadequate subgrade preparation, and even unwise location.

After years of trial and of research many of the major problems appear to have been at least partially solved, but there are still many important items that remain to be worked out, if we are to judge by the lack of agreement among the states on a number of basic points. It may now be assumed, however, that we know how to build a concrete road that will stand up under any given traffic until the material itself is actually worn out, providing scientific principles are followed both in the design and the construction of the pavement, and providing that the loads designed for are not greatly exceeded in practice. In other words, the design and construction of concrete roads has now been placed on a par with the design and construction of reinforced concrete structures, and the same rules relating to design and actual loading will as certainly apply.

In the hope that their comparison may lead to further research and to the elimination of needless waste and confusion in the future, we here devote some space toward comparing the specifications and the requirements of about half of the states on several important items entering into the design and the construction of concrete roads.

A concrete pavement, we all know, must be more than a ribbon of concrete that will keep wheels out of the mud. It is recognized to be a structural slab with certain properties, and to be influenced by a number of different things. During the past few years we have seen various investigations on the factors that influence the strength and the life of a pavement, and these investigations, by no means finished, have resulted in the recent development of several types of slabs. During the past few years the Bates section has become quite popular for many soil conditions, but other designs have been evolved by engineers.

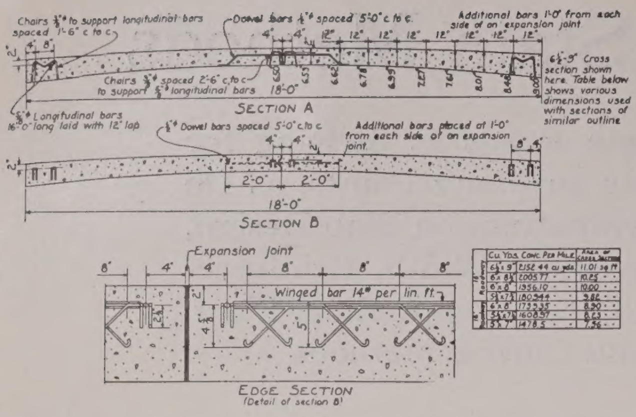
Slab Design

At least two sections have been introduced during the past year—the new Pennsylvania slab and the one just being adopted by New Hampshire. The states of Indiana, Iowa and Michigan have new designs under consideration and might see fit to adopt them for future projects. The Pennsylvania 1925 cross section involved changing the shape of the subgrade to parabolic form, providing for a uniform depth of pavement in the center with a thickened edge, provided by sloping off in a plane on each side from a point three or four feet in from the edge of the pavement. This change was made because it was difficult to form a subgrade in accordance with the 1924 standard. The newer standard form is more practical and results in less concrete overruns. Reinforcing bars are used at the edge, while a dowelled longitudinal joint is used in the center of the slab.

The section now being used by the state of New Hampshire is thicker at the edges than at the center, but the subgrade is given no crown, as far as can be observed from a blueprint of their typical section. The 18-ft. pavement has a thickness of 6 in. in the center 14 ft., while the edge two feet on either side is thickened to 9 in. for the sake of added strength. The pavement is given a 2-in. crown. Macadam shoulders, 3 ft. wide and sloped 2 in. in that width, are added. The concrete is reinforced by deformed bars at transverse joints and along the longitudinal joints and along the edge, as well as transversely every 7 ft. Plain dowels are used in the transverse joints and deformed bars, 4 ft. long, and spaced every 5 ft. along the joint, are used as dowels in connection with the longitudinal joint. The steel is held in place by an approved chair. An 18-ft. pavement of this type will require 1,106.9 lbs. of steel per 100 lineal ft. of roadway.

Subgrade Preparation

Few indeed are the states who do not have a variety of subgrade problems to solve, but many are the states who use a standard method of equalizing the base below the pavement. Under many normal soil conditions it is quite sufficient to lay a bed of gravel and provide for adequate drainage by means of side ditches or drain tile, but since recent researches have demonstrated that moisture weakens


Chairs ⅜"φ to support longitudinal bars spaced 1'-6" c to c
Dowel bars ½"φ spaced 5'-0" c to c
Additional bars 1'-0" from each side of an expansion joint
Chairs ⅜"φ spaced 2'-6" c to c to support ⅝"φ longitudinal bars
18'-0"
⅝"φ Longitudinal bars 16'-0" long laid with 12" lap
6½"-9" Cross section shown here. Table below shows various dimensions used with sections of similar outline
SECTION A
½"φ Dowel bars spaced 5'-0" c to c
Additional bars placed at 1'-0" from each side of an expansion joint
2'-0"
2'-0"
18'-0"
SECTION B
Expansion joint
Winged bar 14# per lin. ft.
EDGE SECTION
(Detail of section B)
Cu. Yds. Conc. Per Mile
Area of Cross Section

The Pennsylvania section, typical of those used in many states

concrete of any age, while it is wet, it has become more generally recognized that subgrades should be adequately protected against any high degree of saturation. This, and the problem of stability, are still harder to meet when one strikes the swamps and peat bogs of some of our states, or the salt marshes and sand dunes of others. Again, certain soil conditions create other ill effects upon the pavement, and all must be taken into consideration on many an important project. Over half the states whose engineers have written to us during the past month have expressed themselves as more or less concerned with the problem.

In California, many soils are very bad for paving, and it is the practice to analyze the soil on every project before work is begun. The resident engineers make determinations of Moisture Equivalent and Shrinkage as a routine part of their work. The usual practice on adverse soils is to lay a wearing surface of fine crushed rock and not to pave until the road has come to rest and is no longer in movement.

We learn from J. T. Hallett, Asst. Chief Engineer, in charge of roads, of the Indiana State Highway Commission, that they "have many different kinds of soil in Indiana, but the only ones we have taken any notice of in either design or construction have been the muck pockets in the lake district in the northern part of the state. In the past some county engineers on county work have provided for removing all the muck and replacing it with more stable material when building a road across one of these places. The state has, in a number of cases, built roads across them and has not removed the muck. We have built the fill and let it stand for some time to reach approximate equilibrium and then paved it. In a few places we have had the grade settle and the pavement present an uneven surface." They have found that by heavily reinforcing the pavement with steel the slab will hold together, and that the unevenness in the surface will not be very noticeable to the traveling public.

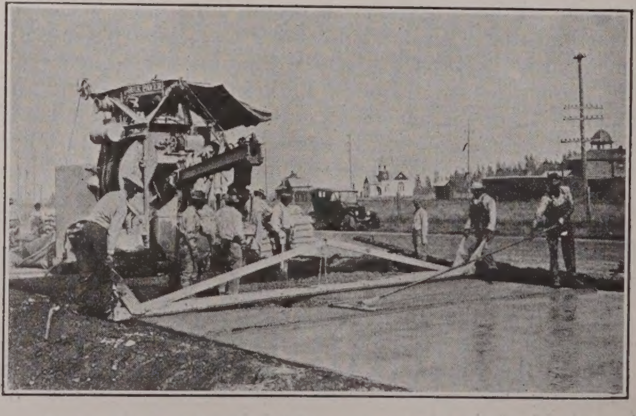
Upon this practice, Mr. Hallet remarks that while this method of solution "is not ideal, it is more economical than taking out the muck and replacing with stable material, and we believe serves the traffic as well. The life of the pavement is, of course, shortened, but in many cases the second road can be built cheaper than the muck can be removed, as has been done in some cases by the counties." (Relocation cannot eliminate many of these muck holes, as your editor soon found out, some years ago, when trying to do that very thing. We remember particularly where one stretch of road had sunk about five feet, while a box culvert structure on the job had gone down about three. That was one of those county fill jobs that Mr. Hallett writes about. The new road had to follow the line of the old one, as the bog was in an old river bed, so the old base was used as a subgrade for the new one.)

Then we hear from F. H. Mann, Asst. Chief Engineer of the Iowa State Highway Commission, that they have had considerable trouble in the past when laying concrete on the Missouri River loess—a light, dry soil encountered in the northern and western parts of that state. They found that the pavement laid on this soil developed innumerable hair cracks in spite of all precautions that could be taken. The cure eventually was found to be the laying of tar paper on the subgrade, which immediately prevented further trouble of that nature.

In Kansas there are several soil conditions that have given trouble, but according to W. V. Buck, State Highway Engineer, no definite policy has yet been adopted. On some of their bad gumbo subgrades they have used a sand cushion or a bed of stone screenings with real satisfaction.

G. C. Dillman, deputy commissioner and chief engineer of the Michigan State Highway Department, intimates that all work in his state must almost be treated as a new problem, because of the great variety of conditions encountered. He speaks of the very sandy nature of a part of the state. "In this type of soil," he writes, "we find it necessary to surface the road from back slope to back slope, utilizing clay or suitable top soil for shoulders, and placing sod on the back slopes to prevent drifting of the blow sand. In other sections of the state, heavy water-retaining soils occur which require tile underdrainage provided with suitable outlets. In this type of soil, we have been making use of gravel and sand subbase underneath the pavement." They have had some very good success with that type of construction.

On an Illinois highway, showing the finishing machine, the steel center joint, and the dowels



Using the long handled float on a pavement in the state of Washington

The state of Minnesota has some pretty bad clay sections, and here the use of gravel or of sand puts the subgrade into condition to receive the slab. In Missouri, we are told by B. H. Piepmeier, Chief Engineer of the State Highway Department, it is the custom to correct some spongy places by first building a light gravel road, about four inches thick, and letting traffic work this into the soil for two or three years. By that time a good base for a concrete pavement is usually available.

In New Mexico it is the practice to reinforce the slab over doubtful spots and over structure excavations and backfill, and over new embankment sections. New York and North Carolina mostly solve such problems as they occur, and the former has a great variety of such problems ever before the resident engineer. Pennsylvania, while believing in adequate underdrainage, is making an investigation of the matter of subgrade preparation, but has not yet arrived at any economical solution, according to W. H. Connell, of that state.

In Rhode Island, according to G. H. Henderson, Chief Engineer of the State Highway Department, they frequently find a soil that is heavy and retains moisture, and which is subject to considerable expansion in freezing weather. In past years it has been observed that a pavement would blow up during the spring thaws. The present preventive is an insulating cushion of course, permeable material, variable in thickness according to existing conditions, which tends to break up capillarity and permits drying out the subbase through aeration. Deep open ditches are constructed where possible, and drains constructed where necessary. Texas uses sand and gravel on the subbase where necessary, while Vermont uses the gravel base and reinforces the concrete where judgment indicates that it is needed. West Virginia is particularly concerned with breaks or slips in hillside construction and devotes careful study toward their prevention.

A different thought on the matter was expressed by F. M. Balsley, Construction Engineer for the Wisconsin Highway Commission. "We do not change our sections," he writes, "when we run into bad soil conditions. The only means of strengthening the slab is by the use of ½-in. steel bars. Over soft places we use longitudinal steels spaced from 12 in. to 2 ft. with sufficient ½-in. bars transversely placed to hold the longitudinal bars in place. The transverse bars are spaced at about 4 ft. centers, and the longitudinal bars are securely wired to them at the intersections. The steel is made up in two mats, so that one mat may be placed at the side of the parting strip at any elevation desired without in any way interfering with the dowel bars. In our opinion it is wrong to attempt to slip the transverse steel through the holes in the parting strip, because of the fact that it is impossible to place the steel in the position it should occupy to give the most effective service. Wherever reinforcing material is installed, the regular dowel bars are used through the parting strip. These are ½-in. deformed bars, 4 ft. long and spaced at 3 ft. 11 in."

Pavement Width

The 18-ft. pavement appears to be the popular one at present in most states, but where a great amount of traffic is observed a wider pavement is often laid. In sparsely settled districts, or when available funds are low, we find pavements ranging in width from 10 ft. to 16 ft. The 20-ft. pavement has been adopted by several states, notably Iowa, Massachusetts, Michigan, Texas, Washington and Wisconsin. New York appears to be partial to the 27-ft. pavement and Michigan has paved some 40-ft sections. Metropolitan areas are already agitating for roadways up to 100 ft. in width, but we have no data on hand as to the status of this great width.

In paving the wider roads, naturally, it is necessary to lay the concrete in parallel sections because of the limitations of the finishing machine. With this plan the work may be so scheduled as to permit an almost normal flow of traffic over the subgrade during construction, as well as over the new slab as soon as the concrete is ready for service. On the narrower roads there is a difference of opinion when it comes to splitting up the work into adjoining traffic lanes. Even where a longitudinal joint

Rubbing down with a carborundum brick, as required in the Illinois specifications

Paving a strip at a time on Indianapolis Avenue, Lake County, Indiana is provided for, the engineers and the contractors prefer to route the traffic over a detour rather than to have it disturbing the progress of the job. It is only when detours are out of the question that this splitting up of the work must be resorted to. Kansas paves her 18-ft. roads in two strips of 9 ft. each, while Massachusetts splits her 20-ft. roads into two 10-ft. strips; Michigan divides her 40-ft. drives into two 20-ft. sections; Missouri builds her 18-ft. roads in one operation, but in some cases has had to pave only a 9-ft. strip with one edge on the centerline of the right of way, and then paving the other half later on when money for that work is available.

The longitudinal float, at work on the Lincoln Highway in Iowa, where it has removed the corrugations on the surface

New Hampshire splits her 18-ft. roads into two strips; New York places her concrete in three strips of 9 ft. each on her 27-ft. pavements; Pennsylvania splits her road into two 9- or 10-ft. strips when necessary; Rhode Island paves her 18-ft. roads in two separate strips, as does Vermont, while West Virginia paves her 16-ft. roads at one time, but splits her 18-ft. roads.

Bars Popular as Reinforcing

Another matter of design is the problem of reinforcing, and there is quite a difference of opinion on the necessity for this item and as to what type to use. It is apparent that twice as many states favor bars as those who favor mesh, if reports from half the states have any meaning, while three states use both or either as the occasion demands. Eight of the states use no reinforcing at all. The states using bars either restrict their use to the edges of the pavement or use them only at slab boundaries and as dowels. Other states, such as New Jersey, use bars throughout the slab. Some states, such as New York, use bars at the edge and mesh throughout the slab, with dowels at the joints. According to the list published by another source, a few more states use the mesh than bars. California uses both types with satisfaction. A few comments upon the situation, as given by state engineers, might be of interest.

Mr. Hallett, of the Indiana State Highway Commission writes as follows: "This state has never used a mesh reinforcing but, in all cases where reinforcing has been used, has used bars. My personal opinion as to whether bar reinforcing or mesh reinforcing should be used depends upon the stresses which are being reinforced against. If it is intended to reinforce against the surface shrinkage of concrete it is entirely possible that the mesh would be more effective. If it is intended that the reinforcing not act exactly as a reinforcing but as tie bars to tie two or more slabs together when a crack appears, it occurs to me that bar reinforcing would be more effective. The bar reinforcing might not be more effective when the crack first occurs, but I believe it would be effective for a longer period than the mesh."

Illinois uses shear bars in edge of pavement, painted and greased to prevent bond, together with dowels at the joints.

Upon this same subject, B. H. Piepmeier, chief engineer of the Missouri highway department, tells us, "We have not used any mesh reinforcement, but we have used the $\frac{3}{4}$-in. longitudinal bars on the edges of our pavement. These bars are not painted or greased. On sections that are subject to settlement we reinforce with bars, to prevent the breaking of the pavement and to assist the maintenanec men in lifting the pavement back into place if settlement should occur. We believe that if the same amount of money required for mesh reinforcing is put into additional thickness of concrete, it will insure a slightly stronger pavement."

James A. French, State Highway Engineer, of New Mexico, uses a little mesh but does not believe reinforcing necessary under the light traffic conditions in his state. He states that the mesh may operate to reduce fine cracks, but that this is merely an assumption. He believes that reinforcement should be used in the slab in the same manner and to do the same work as the reinforcing that is used in the top slab of a culvert.

On the other hand, we learn from W. D. Somervell, acting senior construction engineer, North Carolina State Highway Commission, that they are "not satisfied at this time of the necessity of reinforcing the roadway slab on the usual run of subgrades. We have a type of mesh reinforcement," he writes, "which is the latest design and which calls for larger wires and smaller spacing on the edges of the pavement, and have used it on two projects. On some of our old pavement where bar reinforcing has been used we experienced a large amount of small check cracking which appears to be due to the reinforcement itself," he has informed us.

The state of Pennsylvania does not use mesh reinforcing in slabs ten feet in width or less, but uses it in slabs of greater width where longitudinal cracking might be expected in plain concrete. Bar reinforcing is used in the edges of plain concrete slabs in order to strengthen the corners and to dowel the slabs together at transverse cracks.

The state of Rhode Island follows a similar plan, using mesh reinforcement for uniform distribution and bar reinforcement along the sides and corners, dowels at the transverse joints and tie rods at intervals along the longitudinal joint. The Texas state highway department considers the mesh reinforcement more satisfactory than the bar variety. On the contrary, the state of Vermont does not use mesh because they have trouble holding it in place satisfactorily. The state of Washington favors the use of bars as being the most practicable that has been tried. Bars are used in rows near the edge of the slab to guard against a perimeter and corner failure. The cost per pound of bars is less than the cost per pound of mesh reinforcement in that state.

Upon this subject we quote F. M. Balsley, construction engineer, Wisconsin Highway Commission, who writes as follows: "We do not use mesh reinforcing except in city and village work. Bar steel is always used in the country paving where necessity requires. We are of the opinion that mesh reinforcing simply acts as a restraining agent which will keep cracked slabs from separating for a short time. It is true that mesh reinforcing rusts through very rapidly whenever a crack forms. We very much doubt its efficiency on soft subgrades on country highways. The condition in village or city pavements, where a curb and gutter prevents the water from running under the slab, is entirely different from the condition that obtains in the country where no such protection is afforded the slab."

Proportioning by Weight

Although the subject of proportioning concrete by weight has become quite popular with some building contractors, and theoretically should give far better results than will volumetric proportioning, yet few are the states where this method is written into the specifinations. One state, Iowa, has definitely adopted the practice, while at least one makes its use optional with the contractor, and others are investigating its possibilities. Other states have decided that either no change was practicable or that the method is more beneficial to the contractor than to the state.

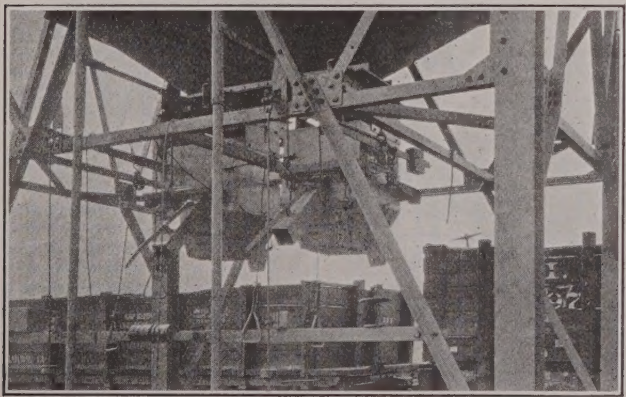
F. H. Mann, of the Iowa State Highway Commission, has had two years of experience with proportioning by weight. In his letter to us he writes to the following effect:

"For the past two years we have been proportioning by weight. We feel the engineers and contractors are entirely satisfied with this method. I have personally heard a number of our contractors say that if they were allowed the privilege of choosing between the two methods, now that they have tried both, they would most certainly choose to proportion their aggregates by weight. This method offers a number of advantages. In the first place very definite corrections can be made for moisture. We find that the amount of cement used with this method comes more nearly to approaching the correct amount. We find that the batches are more uniform; the operation is speeded up rather than delayed, and further, it offers a very satisfactory check on the amount of aggregates shipped in by the contractor.

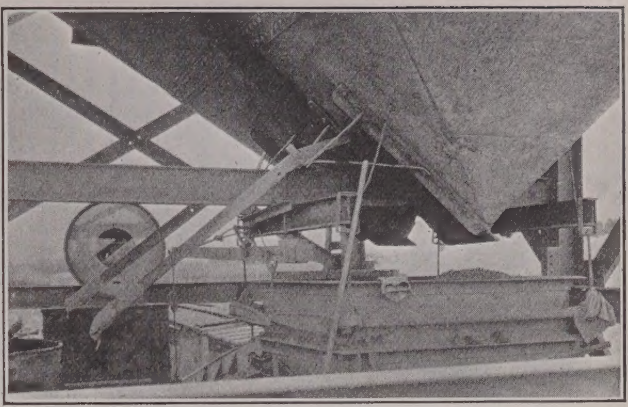
"In our state a great many times aggregates are shipped by rail from places where there is no opportunity of weighing. Railroad companies have been known to 'guess' the weights and quite frequently to guess too large. There are a great many things to be said in favor of the weighing device which space will not permit me to enumerate."

California permits the use of both weight and volumetric methods of proportioning and finds the contractors are partial to weighing. This works out to the satisfaction of the engineers, except where sand comes directly from the water. Stockpiling will be required to correct the difficulty.

The state of Kansas allows the contractor to use the system if he desires but has not made it mandatory, though they look upon it with favor. The state of Massachusetts has not seen fit to depart from the volumetric system. Their engineer does not believe weight proportioning would be feasible on concrete road work where the mixing is done on the road itself, but believes it possibly adaptable to use with a central mixing plant—which is forbidden in that state. Missouri is still using the volumetric method, according to Mr. Piepmeier of their highway department. They have, however, tried the weight method in two or three instances and like it very much. They feel sure that the latter method will be used extensively within a few years. The weight method, their engineers say, insures more uniformity and a saving to the state and to the contractors. The state of Nebraska has tried out the weight method of proportionment and is thinking of adopting it for the coming season. Pennsylvania is skeptical about enforcing correct weighing of aggregates and is trying to see how the proposition can be worked out. West Virginia, while still using the volumetric method, will probably revise the specifications to proportioning by weight. Wisconsin has never proportioned by weight. Mr. Balsley, of that state, has advised us that they "have given the matter considerable thought and it is our opinion," he said, "that it would work out to very good advantage with the fine aggregate, but would not give as good results with the coarse aggregate, due to the wide variation in the void percentage in materials from the different commercial plants. There is no question," we are informed, "but what the bulking of sand, due to dampness, has an appreciable effect on the strength of the resulting concrete, but with the 1:2:4 mix used in this state, it is always on the safe side. In other words, if the sand is damp it results in a stronger mortar than if the sand is dry. The saving in cement, however, would probably offset the added cost of weighing the material.



Proportioning by weight in Iowa by means of special scales



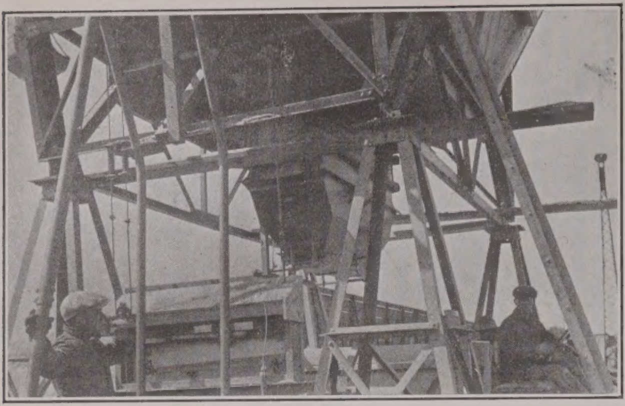
Weighing device on central mixing plant in Iowa

"We are not so sure," he continued, "that weighing coarse aggregate would give us the results that we are after. Given a coarse aggregate, with high void percentage, it stands to reason that the given volume would weigh less than if the void percentage were low. This would not materially affect a 1:2:3 mix, but would have a very marked effect on a concrete mix of 1:2:4. We hope, at some later date, to have a chance to experiment with this method of proportioning material."

It is evident from the above opinions and experiences that a great deal of attention will be paid to the weight proportionment of aggregates during the next few years.

Longitudinal Float

When the motorist goes over the ordinary concrete road he feels a series of dips or waves, due to the usual finishing methods in use. This uneven riding is taken as a matter of course since the gravel and the black-top pavements naturally wear into a series of ridges or waves, and the average driver has become quite used to them after years of driving over all sorts of roads. This un-



The Blaw-Knox scales for weighing aggregates, as used in Iowa

comfortable sort of a concrete pavement is going into the discard, however, and it is now possible to finish a pavement without having the series of corrugations that help to make long distance driving a tiring task, and that increase impact loads that are so destructible to the pavement.

The longitudinal float has been developed for the purpose of wiping out the transverse waves or corrugations in the finish that are often left by the finishing machine and the ordinary float. This new tool, adopted by a number of states, turns the unavoidable corrugations at right angles to their usual transverse course, and makes them parallel to the line of travel instead of opposing the line of travel and therefore makes them harmless. These floats, operated either from two "bridges" or by long handles from the side of the road, are said to provide a far more even surface, at no additional cost, as floats would be used at any event. At least 12 states require or request their use, while others are seriously considering adding this item to their specifications. This new practice, originated in the west, is gradually moving eastward, and is one of the real advances of the year.

In commenting upon this method of finishing, California and Colorado find it very satisfactory; Delaware, Florida and Indiana do not use it; Iowa tried it out in 1925 and found it very satisfactory; Kentucky allows its use at the option of the contractor; Kansas finds it very beneficial, as does Maryland, while it has not been tried in Massachusetts, or in Michigan, has been found worth while in Minnesota, has been found very satisfactory in Missouri, is not used in Nebraska or New Hampshire, but is quite successfully utilized in New Mexico. This latter state uses one 10 ft. long, and limits its use to three sweeps across the pavement, as otherwise it tends to work out the crown. Nevada has used the longtitudinal float and has found it very satisfactory. New York has not adopted this finishing tool, but it is used in North Carolina, Ohio, a long handled variety is used in Oklahoma, the regular longtitudinal float is used in Pennsylvania, where too much finishing must be avoided; it is not used in Rhode Island, but is well liked in Texas; will soon be tried in Vermont; is not used in Virginia; is extensively utilized in Washington; is not used in West Virginia, Wisconsin or Wyoming. This accounts for over half the states, while the rest have not reported on this subject. The use of this float is said to eliminate a lot of hand finishing and to greatly improve the riding qualities of the pavement. It has proven useful in removing laitance and imperfections in the surface, but too much floating will tend, it is said, to work out the crown of the pavement.

Water-Cement Ratio

As far as we have been able to discover there have been but five states to adopt a water-cement ratio form of specification for their paving work, and these states are Massachusetts, Nebraska, New Mexico, Texas, and Wisconsin. Other states are giving the matter some thought, especially Kansas and Minnesota.

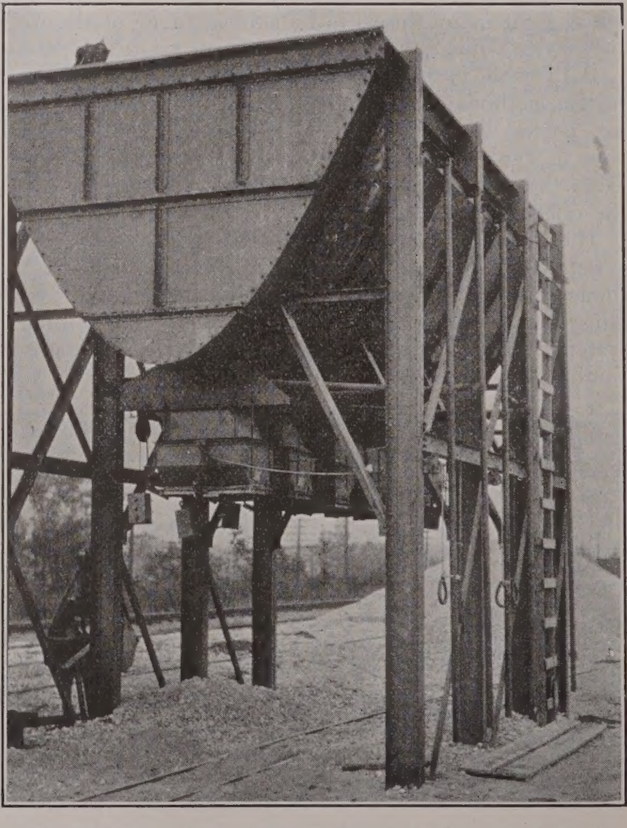
In California, where other ideas are being tried, the engineers tell us the following interesting facts. They write that:

"The amount of cement we use per cubic yard is as nearly consistent as the percentage of voids in our aggregate will permit and our water content is always kept the lowest at which it is possible to work the particular material. Our material is carefully graded to secure the minimum of voids, and we are also particular with regard to the sizes of materials used, particularly our fine aggregate. Our determinations of greater strength of concrete to be determined from certain aggregates are not fixed, as we find that different gradings from the ones we specify will give better strengths. While the usual gradings such as Fuller's curves, may in some cases give satisfactory results, the shape of the material dictates to a considerable extent the proper proportion of the different size in any grading and this it is necessary to determine experimentally."

Curing Methods

Extensive investigations of curing methods have recently been made, and reported in the technical press. Important among these investigations are those that demonstrated the importance of curing within the first ten hours, and the demonstration of the superiority of the wet-earth method as discovered by the state of California.

It is with great interest that we note the experiences and opinions of the highway engineers of many states as to the matter of curing, and it is not surprising when we find that a majority requires a process that includes the use of wet earth or permits its use on an optional basis. The use of ponding appears less general, straw is often



The Blaw-Knox Batcher on the Dunes Highway in Indiana used, while a number of states require the use of wet burlap or canvas for the first day or so. The use of calcium chloride, while permitted in at least 6 states, is frowned upon by others.

The state of California informs us that their standard curing method is ponding. As reported to us by the engineers, the state of Colorado has the slabs covered with earth and requires that it be kept wet for the entire curing period. Delaware reports that ponding is used when possible, otherwise damp earth is the curing medium. Wet curing is continued for the first fourteen days, and then the slab is cured dry for another fourteen days before opening it to traffic. In Florida the pavement is covered with two inches of dirt and kept wet for 18 days. Indiana has, in practically all cases, insisted on the water and straw curing for concrete. In a few isolated cases they have permitted the use of calcium chloride, but are very cautious in its use, since they have not been fully informed as to actual properties of that material.

Wet earth curing in Washington

Illinois permits the use of calcium chloride and finds it the popular method with contractors. Some wet-earth curing has been used.

In Iowa the standard practice is to cover the surface with two inches of dirt and sprinkle this covering for ten days. Under special conditions this state will permit the contractor to use calcium chloride. This was done in a number of cases last summer when water supplies on some work were inadequate for both mixing and curing, but in all other cases the wet earth method is insisted upon.

Burlap on wheels on a job in New Mexico

Kentucky allows the use of calcium chloride, wet earth covering, or ponding, as the contractor desires. Kansas does likewise, and finds that practically all the contractors have accepted the calcium chloride treatment, as they find it cheaper and entirely satisfactory. In Maryland the practice is to cover the slab with wet burlap for the first day, and then to cover with earth that is kept wet for 10 days. The dirt is removed at the end of 18 days. In Massachusetts the slab is covered with two inches of earth on the day following that on which it was laid. This is kept wet for not less than ten days, when the earth covering is removed and the surface kept clean. The road is then kept closed to traffic for three additional days.

Spreading the burlap on a highway in Iowa

The Michigan state highway department requires the pavement to be covered with earth, straw, marsh, hay, or other fibrous material and kept wet for 14 days. Ponding may also be used. This organization has permitted the use of calcium chloride applied at the rate of two pounds per square yard as a substitute for the standard method, but only on written permission from the construction department. Thus no contractor may use this method unless he has demonstrated that he will use the proper care on the job in the application of that material. They have not yet come to the point of opening the specifications to the use of calcium chloride.

Minnesota uses the wet earth method, continuing the treatment for 14 days, or permits the use of ponding, or the contractor is allowed to use two pounds of calcium chloride per square yard of surface if he so desires. During 1925 it was found that most of the work was cured with calcium chloride, as the contractors found this the most economical method. It is necessary, say the engineers of that state, that the calcium chloride be spread uniformly and that any concentrations be immediately removed in order to avoid damage to the concrete.

Straw curing as used by the Indiana State Highway Commission

Practically all of the concrete roads in Missouri are cured with the use of calcium chloride, on the basis of 2½ pounds to the square yard. Some wet straw and wet earth is being used, but seventy-five to ninety per cent of the work is being done by means of the calcium chloride. This is considered satisfactory, as it seems to insure uniformity and is productive of the desired results.

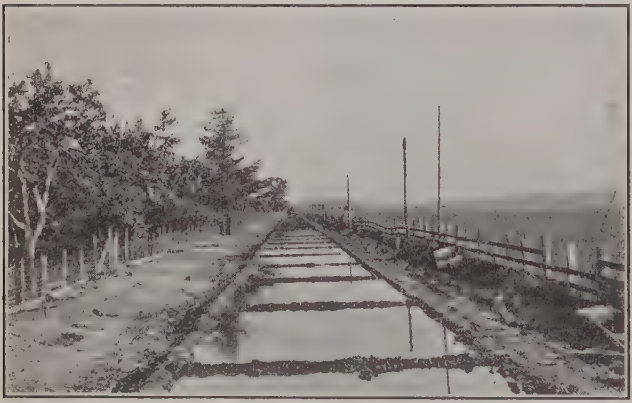
M. C. Noble, chief of the Bureau of Roads and Bridges of the Nebraska Department of Public Works, tells us that his department permits the use of four methods; earth curing, straw curing, ponding, or calcium chloride: The straw covering is seldom used, since it cannot be kept in place during windy weather. Calcium chloride is generally used on rolling profiles, and the ponding method is used on the level stretches, although the contractor is allowed to choose his own methods. Immediately after the concrete is finished, and before it has taken its initial set, burlap is placed on the surface. This burlap is rolled on an axle mounted on two wheels rolling on the pavement forms. By means of this equipment the burlap can be unrolled and laid upon the surface of the pavement very close behind the mixer. This burlap is kept moist for several hours. As soon as the concrete has taken its final set the burlap is removed and one of the above four methods of curing is started. This curing process covers a period of at least ten days. The ponding method is specified in Nevada.

New Hampshire uses wet burlap for 3 to 8 hours, and then applies a layer of wet sand or wet hay that is left in place for 8 to 14 days. New Mexico provides for the use of canvas or burlap until the concrete has reached its final set, and then calls for ponding, wet earth or straw, or spraying for ten days. New York uses the burlap, and then follows up with 6 inches of wet hay or straw for ten days, and opens the road to traffic in 21 days. North Carolina uses wet earth curing and ponding, but has discontinued the use of a covering of calcium chloride as the latter method has caused them quite a bit of trouble with scaling. They are, however, using it as an admixture, two pounds per sack of cement, and believe that this will give better results.

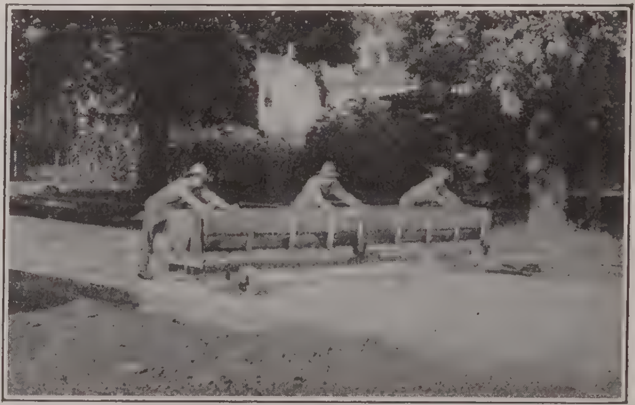
We understand that Ohio is another state that uses the wet burlap for the first day, and then follows up with 2 in. of wet earth or 3 in. of wet straw, which is kept wet for at least 9 days. Oklahoma follows the same policy, except that the covering is kept wet for 14 days and is left on the pavement for 21 days. Calcium chloride was tried but was not found to be satisfactory. Pennsylvania uses a double burlap, which is kept in place until the following day, when wet earth or straw is substituted. This covering is kept wet for eight days and is left on the pavement for eighteen days at the end of which period it is removed. The road is not opened for traffic until at least twenty-one days after the slab has been finished. Rhode Island uses the wet earth method entirely. Texas uses the ponding method or wet earth curing, as these methods have proven more satisfactory than calcium chloride in their estimation. Vermont uses canvas for the first day, and then wet earth, according to their engineer.

The state of Virginia uses wet burlap until the concrete has set, and then uses wet earth, which is kept soaked for fourteen days and is left on the pavement for twenty-one days. At the end of this period, as soon as the covering has been removed, the road is opened to traffic. Washington uses two methods; covering and sprinkling, or diking and ponding. West Virginia specifies wet earth curing on all work.

Wisconsin specifies the use of wet burlap, which is then followed up by wet earth, two inches thick, or ponding, either of which are kept in effect for two weeks. Calcium chloride is permitted in the quantity of 2½ lb. per sq. yd.



Ponding, as used in Washington



A homemade device for spreading calcium chloride, as seen on an Illinois job

Spreading a light earth curing cover over calcium chloride,

Unrolling canvas or burlap, as it is often done

EDITORIALS

The Turn of the Year

The construction industry is preparing for a new season, and is looking not only to the prospective business of the near future, but is busily overhauling old machines, purchasing new equipment, and sounding out the material and labor markets to see what work is to cost. Contractors are beginning to discover the likelihood of an immense volume of construction, but realize that work may not be quite as plentiful as it was in 1925. Labor, it is being said, will be quite adequate except in two or three of the skilled trades. No radical changes are expected in the material markets, except for the usual increases during the spring rush. In spite of the possible slowing down of general construction, figures indicate a continuance of the upward movement in the use of concrete in all types of building construction. In fact, the builders see the probability of another good year for concrete construction, with its savings in material and labor, and are planning their work accordingly. Many a products manufacturer is beginning to wish that he had not hibernated over this winter but had kept things moving, had cultivated his trade, and had laid up a yard full of products to take care of the great demand to come for spring building. Three months to go, and the drive will be on.

A Thought on Equipment

The past twenty years have brought startling advances in the art of making concrete. There seems no end to the useful discoveries that are leading to better and more economical and more permanent construction. In fact, some men now say that we know how to make better concrete than we are able to make. Theory has advanced rapidly and lead practice a merry chase. The equipment manufacturer finds it difficult to keep in step, and in turn is devoting his attention toward the development of machines that will enable the contractor to turn out concrete that is as good as the engineers say can be obtained. It is evident that the contractor often finds it difficult to produce a theoretically good mix because his tools require an undue amount of labor to achieve the desired results. The mixing and placing of a batch of the desirable consistency is difficult of achievement. Perhaps our structural designers and our equipment designers could get together and work out the basic problems, the solution of which would make it easier for the equipment manufacturer to keep in step with the laboratory shark. If our equipment is inadequate, then surely it is time that new and improved models or totally different machines be put on the market at the earliest possible moment.

Standardize Road Procedure

To the man who studies and compares the specifications for the design and construction of concrete highways in the various states of the union must come the idea that there is apparently an unnecessary lack of agreement as to the proper way of obtaining a good pavement. Can there be any reason to suppose that the widely varying designs and methods are all correct and beneficial? Can it be that conditions vary so widely as to make this variety essential? As it stands now there seems to be plenty of room for standardization, and this work is in the line of activity proper to the Bureau of Public Roads. Let us decide on the best designs and the best methods, and then cast all the lesser efficient ideas into the discard. Research leading to an early policy of unity would be eminently worth while. We progress by the trial of all good ideas, but retention of worthless methods clogs the wheels of progress.

The Original Admixture

The innocent bystander frequently wonders why municipal paving is frequently of poorer quality than is to be found on State and Federal jobs. The answer, apparently true in a number of places, seems to be the use of an old and harmful admixture in every batch of concrete—politics. In the smaller place, or even in the larger community, the man in charge of improvements is a political appointee with more or less—often less—engineering training or experience. Specifications are a matter of tradition, and are often honored more in the breach than in the observance. Hearings nominally public, are well controlled and the poor taxpayer has but little voice in what is to be done. There is often a list of favored contractors, and supervision of their work may conceivably be but cursory in nature. Disputes as to quality are settled on the basis of interest and not of fact. All in all, the injection of this ancient admixture can do little to advance the quality of the mix.

On the other hand the paving done by the state is often of better quality. With Federal co-operation, specifications are evolved as a result of scientific determination. Costs are usually minimized. Inspection is more severe. Under careful control and restriction the average pavement represents a dollar's worth of paving for every dollar the taxpayer or bondholder contributes.

Some admixtures may be properly used to the benefit of the mix, but politics is not one of them.

Our Cover for January

Our January cover illustrates something that is not seen every day—the inside of good concrete. The cover design is made from a photograph of a sawn section of gravel concrete, made according to the best methods and therefore an example of good material. A great carborundum-toothed circular saw, whirling through a massive beam, exposed this face in order that the true nature of the material might stand revealed.

We like to think of our magazine CONCRETE as being "the inside of good concrete,"—filled with the real facts and ideas that will enable all users of concrete to continually improve their product, their own progress, and their profits. We pledge to you our co-operation and service during the coming year, to the end that all concrete may be as sound as the section shown on our cover this month.

Some Concrete Equipment That Is New

At the Good Roads Show in Chicago Are Many Types of Equipment and Materials—Here Are a Few of Them That Are New and Interesting

In order that you, our readers, may easily obtain the information that you should desire to secure should you visit the Good Roads Show, to be held this month in Chicago, we will herein describe some of the exhibits. We shall merely be able to afford space to some of the new equipment that is of direct interest to the man who handles concrete, as space is too limited to tell about all of the two hundred or more exhibits, all of which are worth while. With the hope that these notes will prove of help to you in planning your equipment requirements of the coming season we are describing below a few of the many machines that have been developed for your consideration.

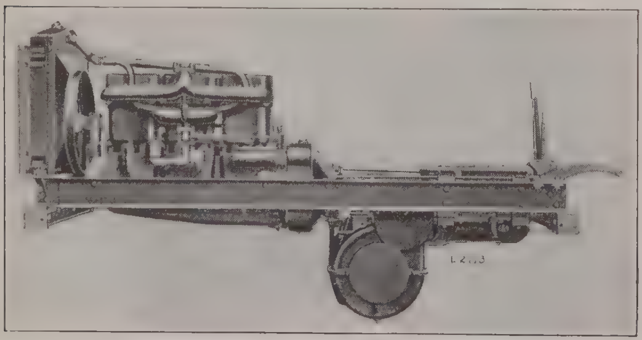
Locomotives

Among the exhibits devoted to gasoline locomotives are the new model 18 and 20-ton outfits just announced by the Milwaukee Locomotive Mfg. Co., and typified by the smaller 7 ton model on display. Built for all sizes of track from 30 to 56½ inches, these machines are of the four speed gear and chain drive type, and are geared for four speeds forward and four in reverse. The transmission is of the jaw clutch and gear type, and is designed to eliminate stripping, and the chattering that is found in some transmissions. The final drive shaft in this transmission is so designed that the driving sprockets are centrally located between two bearings, providing rigidity and eliminating the need for a separate jack shaft.

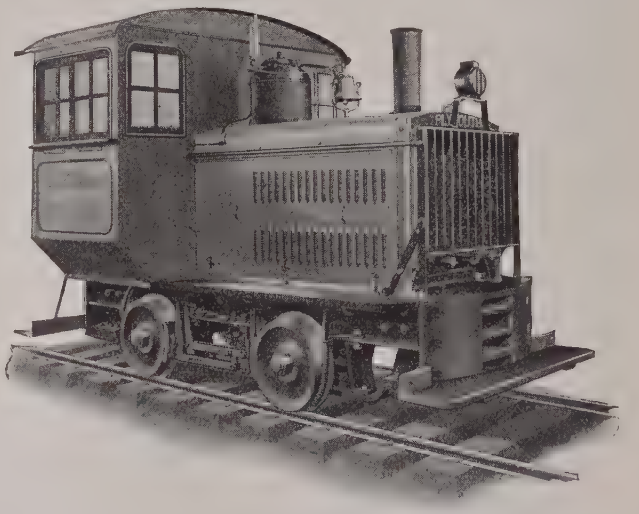
The engine is of the Beaver six cylinder heavy duty type, with overhead valves, forced feed oiling, and a maximum speed regulating governor. The carburetor is a Wheeler-Schebler model A. T., and is equipped with a United air cleaner. The clutch is of the Hele-Shaw heavy duty type. A high tension two spark magneto with impulse starting coupling is used. The entire power unit is mounted on a substantial sub-frame, the cab is large and roomy and of steel construction, the operating levers, clutch pedal, switches, etc., are conveniently located in the cab, and altogether the locomotive appears to be good for considerable economical service.

The Fate-Root-Heath Co. (Plymouth Locomotive Works), Plymouth, Ohio, has recently brought out a new Locomotive, known as Model JLB, weighing 12 tons, which is to be seen at the Road show.

It is built in all gauges from 23⅝ to 56½ inches, with a wheel base of 63 inches. Length over-all is 15 feet, 8 inches, and the height is 9 feet, 10 inches. The frame is of all steel construction with cast-steel bumpers. The Locomotive is powered with Buda 6-cylinder engine, 4½ inch bore by 6 inch stroke, developing 88 H. P. at 1400 R. P. M., equipped with Leece-Neville 12-volt starter with Bendix drive and Willard battery. Bosch magneto, Stromberg carburetor, United Air cleaner, Pierce governor and Modine sectional radiator are standard equipment.



The power unit of the new 18 ton Milwaukee Gasoline Locomotive, toegther with the four-speed transmission that carries the power to the wheels.

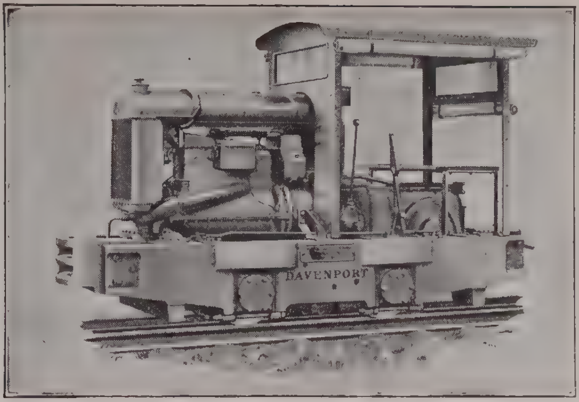


The New Plymouth 12 ton Gasoline Locomotive shown for the first time this year.

Transmission is Plymouth sliding gear type, with four speeds forward and reverse; gears are alloy-steel, cut and hardened. Speeds of 3½, 5½, 11 and 18 miles per hour at engine speed of 1,400 R.P.M. are provided for. Clutch is combination Twin Disc and Plymouth. Axles are of alloy steel, 5⅛ inch diameter; axle bearings are Hyatt high duty, and lubrication is by the Alemite system. Brakes to all 4 wheels, hand operated; or equipped with Westinghouse direct air system. This locomotive is particularly designed for construction duty.

A new 4-ton gasoline locomotive, recently announced by the Davenport Locomotive Works, of Davenport, Iowa, is to be seen this year at the show. This machine, incorporating the Fordson engine and transmission parts, is very rugged, simple and accessible in every part. The design is flexible, allowing the use of a canopy cab, fully enclosed steel cab, or removal of the cab altogether. The operating levers are placed within easy reach at the right hand side of the cab. The locomotive has a speed range of 3 to 14 miles per hour and a maximum tractive power of 2,125 pounds. Starts on gasoline and runs on kerosene.

Another new locomotive displayed this season is the 12 ton worm gear drive machine just introduced by the Vulcan Iron Works, of Wilkes-Barre, Pa. In detail, this ma-

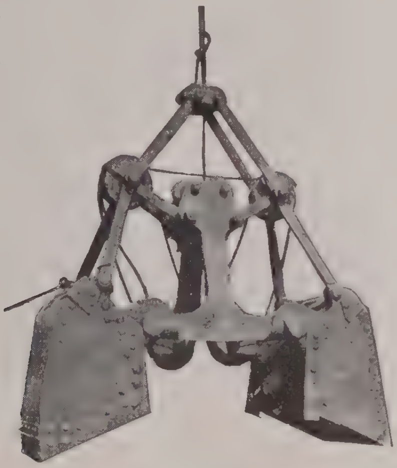


The new 4-ton Davenport Locomotive with Fordson power unit.

chine is but a larger size of the locomotives made by the same concern during the past year, and has been added to the line to provide a heavy duty machine for heavy hauling in quarries and on similar work.

Clamshells

Among the clamshell buckets shown among the various exhibits the new one just announced by the Bradley-Badger Engineering Company, Inc., stands out as worth attention. In fact it seemed to some to be the answer to the demand recently expressed by Peter Crowley in another issue of CONCRETE. In short, the new Bradley-Badger clamshell bucket looked to be one that could really dig.



The Bradley-Badger Clamshell shown for the first time at this year's show.

The unusual feature of this bucket is the design that keeps the shieves and bearings up out of the work. There is nothing to interfere with the job of the scoop. Another feature is that the scoops are given the same motion as used by a man who is busy digging with a spade, who first pushes the blade into the ground and then pushes down on the handle.

The scoops are made of 5/16 in. to ½ in. boiler plate, depending upon the size of the bucket, with heavy angle irons at the corners. The lip of the bucket is made of heavy chrome nickel steel to provide long wear. The steel hinge casting is riveted to the back of the scoop and down the side, forming a corner brace and carrying the stresses transmitted from the lip and relieving the plates of a great portion of this stress.

The hinges are back of the center, and each scoop has its own hinge. When the bucket is dropped into the material the scoops stand straight up in a digging position, and all working parts are clear of the material. When the bucket starts to close one scoop is pulling against the other. A clever arrangement of toggle action in the power arms causes the scoop to swing in from the hinge pin, digging into the material. Little wire is needed in closing, and the action is said to be very rapid and positive. Users are reporting unusual efficiency and longevity on handling aggregates and on excavation work, it is said.

Excavation Machines

Besides the power shovels and cranes an interesting feature of the show is a variety of equipment designed to excavate subgrade in preparation for paving. A new device, just announced by the Western Wheeled Scraper Company, Aurora, Ill., is intended to be hitched in back of a motor truck and pulled along the subgrade, plowing up the dirt and loading it into the truck. Particularly designed for use on city streets, this machine operates with the least inconvenience to traffic. Through an ingenious arrangement of carriers it delivers the furrow at the forward end of the machine, where the material is picked up by a conveyor and carried forward and upward and dumped into the same truck that is pulling the grader. When this truck is full it is quickly released and driven to the fill or dump, while an empty truck is attached almost as quickly. The machine is said to have been thoroughly tested on a number of jobs during the past two years, and is now finally perfected and ready to place on the market.

The New Western Street Excavator and Truckloader announced for the first time at the road show.

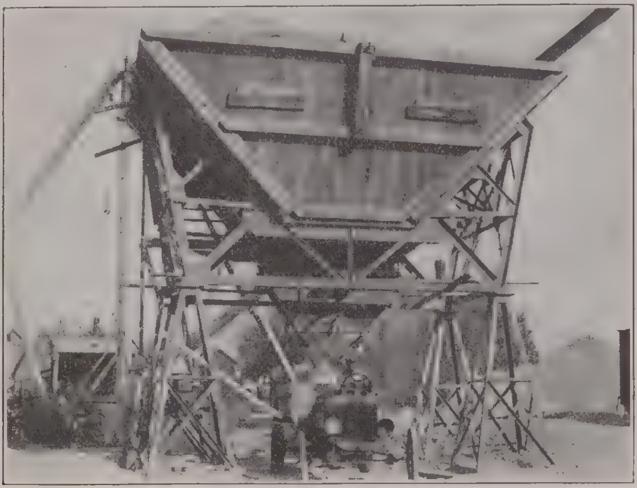
Another new excavator shown this year is the 1926 model of the Insley Excavator. This new model, manufactured by the Insley Manufacturing Company, Indianapolis, Ind., has a boom two feet longer than on the older machine. The construction throughout appears heavier. The transmission has been redesigned for two speeds forward and one reverse, whereas the old machine used a transmission with three speeds forward and one reverse. The hoisting machinery operates in low gear. The new machine has been given a steel top and canvas side curtains.

Another type of grader, while shown outside and not inside the show, and represented only by literature inside the building, is that manufactured by the Bay City Dredge Works, Bay City, Mich. A new Model 4½ yard machine was placed on the market January 1. This is a convertible outfit that may be equipped with skimmer and trench scoops or with a boom and ½ yard shovel or clamshell as desired. This machine, similar to the larger model demonstrated but smaller and of lighter construction, has features that will be of interest to the contractor who needs the smaller types of equipment.

Aggregate Storage and Proportioning

The great interest taken in the subject of the proportioning and handling of aggregates has resulted in equipment that is far in advance of anything hitherto shown. An outstanding feature of the show this year is the exhibit of the Blaw-Knox Company, of Pittsburgh. This particular portion of the show demonstrated the Blaw-Knox duplex storage bins as equipped for volumetric proportionment of sand and stone by means of the quick adjusting batcher, for inundation measurement of sand and volumetric measurement of stone, and for weight proportionment of both aggregates. A new 72 ton bin is a great feature. Another item of interest is the new 1926 model road form with the 1/4 in. steel plate lock joint.

The 72 ton Batcher plant is shown as equipped for inundation, the outfit including an all steel bin, Inundator, water measuring apparatus, and a stone batcher—making a very modern central mixing plant with the exception of a mixer. A motion picture film projected in the booth was utilized to demonstrate the theory and practice of the inundation process and show how the system increases the yield of concrete, prevents overrun of cement, and insures a production of concrete that is automatically uniform and in exact accordance with specifications.



Here are the new weighing batchers in use with a 75 ton Batcherplant, on a recent highway job. This equipment, which permits accurate proportioning, is a feature of the show.

The plant for proportioning aggregates by weight, as is now required by a number of states, has been well worked out by the Blaw-Knox Company, from the appearance of the plant shown in the exhibit.

The weighing arrangement consists of a hopper or weighing batcher of patented design suspended beneath the sand and stone openings of the bin and so arranged that both the fine and coarse aggregates are contained therein, although the materials are kept separate by means of a steel partition. The flow of material from the storage bin to the hopper is controlled by a roller bin gate, also a Blaw-Knox product. The weighing batcher or hopper is connected to a standard beam scale by an overhead system of levers, the whole ingeniously arranged for one man operation. In use the scale is set for the correct weight of the stone. After this material has been weighed the scale is then adjusted to cover the combined weight of both sand and stone. Then the sand is admitted into the batcher, which, of course, when sufficient in quantity, balances the scale. The materials are then discharged into the truck or receiving hopper of the mixer through a simple latched counterweight bottom dump door. This weighing system can be used in connection with almost any variety of storage equipment or as part of the Blaw-Knox Batcherplant. The scales and method of operation are shown in the illustration above.

The Butler Bin Company, Waukesha, Wis., is displaying a set of measuring hoppers (sand and stone) for proportioning batches by volume, a hopper and scale for proportioning aggregate by weight, a model of a steel bin and a number of pictures of bins and hoppers in actual operation.

The volume proportioning or measuring hoppers consist of two filling gates to which is attached a sand and stone measuring hopper, adjustable for 4, 5 or 6 bag mix, with separately controlled discharge doors. They are equipped with non-jamming roller type filling gate arranged so both stone and sand hopper can be operated on one lever or each can be operated independently. Material is measured in a closed volume which cannot vary. Indicators show when the hoppers are full.

The weight proportioning hopper consists of two separately controlled gates, one for sand and one for stone, to which is fastened a five point suspension scale. Attached to the scale is a two-compartment receiving hopper with separately controlled discharge gates. The scale is arranged so sand and stone can each be weighed separately.

The hopper is equipped with drawoff spout so in case of carelessness on the part of the operator any excess overweight can be easily drawn out of the hopper.

The weighing hoppers are designed so they can be easily moved, and a scale is used which is so simple that any fairly intelligent man can set it up and adjust it without the aid of a factory expert. The outfit is heavily built and has no delicate parts to get out of adjustment and cause trouble.

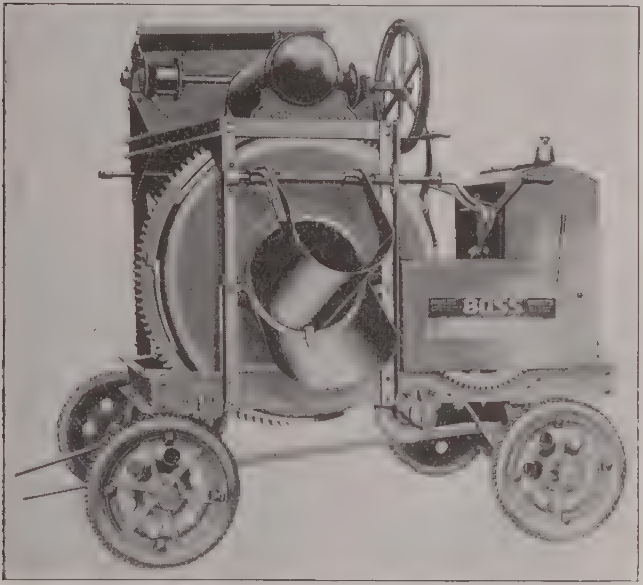
The Butler Bin and Weight Proportioning Hopper as used in the field.

Mixers and Pavers

A big feature of the show this year, as in former years, is the up-to-the minute machines for mixing concrete and for placing it on the sub-grade. Each year the mixers and pavers grow stronger and more mechanically perfect. Each year there are improvements that will add to the life of the machine, that will enable it to turn out a more uniform batch in the minimum time, and that will add to the efficiency of the job.

An interesting section of the Koehring Company exhibit is that devoted to their 27-E Paver and their sub-grader to be attached thereto. The paver has just been improved as a result of experience and of the requirements of the users. The water tank has been changed to an air pressure system, which gives a speedy influx of water in accordance with the Illinois specifications. There is now an adjusting valve on the tank that provides accurate and minute adjustments by means of a worm and worm segment, thus making it possible to adjust the water contents of the batch in accordance with the requirements. The transmission has been enclosed and the gears and other working parts run in an oil bath. This keeps them free from dirt, grit, and dust. This unit, similar in practice to that used in the automotive industry, completely encloses all of the driving mechanism, from the motor to the drum and the traction mechanism.

Another mixer of interest is the new One-Two Bagger displayed by the American Cement Machine Co., Inc., Keokuk, Iowa. This is an oversized one sack mixer that is built entirely of steel, with a pressed drum 48½ in. in diameter with steel tracks, and that holds 15 cubic feet of loose material, one sack batch of any proportion or a two sack batch of 1:2:4 mix. This machine, which is as light as any standard one sack machine, is equipped with Hyatt roller bearings, 8 H. P. LeRoi engine, cross discharge, power charger, water tank, pneumatic tired steel wheels, enclosed gears, and other refinements.



Boss One-Two Bagger mixer announced at the show.

Of interest among the mixers is the new Rex 27-E six bag paver, just announced by the Chain Belt Company, of Milwaukee. Their new Rex 14-S mixer also merits attention. The 27-E machine is mounted on full length chain treads with enclosed transmission drive, and has a collapsible top frame. The power is secured from a 40 h. p. Waukesha motor with a Ricardo Head. Operating levers are conveniently placed. A new distributing bucket is quick discharging and designed to handle the dryest mix. The capacity of the new machine is guaranteed to be six bags of the 1:2:5 mix.

Another mixer that is worth seeing is the new 7-S mixer recently perfected by the Leach Company, Oshkosh, Wisconsin. This machine, intended for building construction and bridge work, is an unusually simple piece of mechanism. All parts of the machine except three—the center drum ring, trunnion rollers, and pinion—are of steel, while the three exceptions are of semi-steel. Lubrication is by the Alemite system. All controls are conveniently mounted at the end of the mixer, making it a strictly one man machine. Fuller & Johnson or LeRoi engines are supplied as desired, two and four cylinder units.

Power Saws

Contractors who do bridge and building work find the Jones Superior Machine Company exhibit of interest. This Chicago firm is showing for the first time their new Super Woodworker, a contractors' saw rig that has been especially designed for cutting form work and for other duty about the job. Essentially interesting features are the tilting table and the swinging arbor, which have made this device quite handy for this class of work, and which promote fast sawing and permit special cuts as required. This saw rig can be equipped with a four horsepower LeRoi engine, or a three horsepower electric motor as required. It is normally equipped with a 14 in. cross cut and rip saw, but will take saws up to 16 in. The saw is pulled through the work by foot or hand power by using either the foot pedal or the hand lever at the will of the operator.

Conveyors For All Purposes

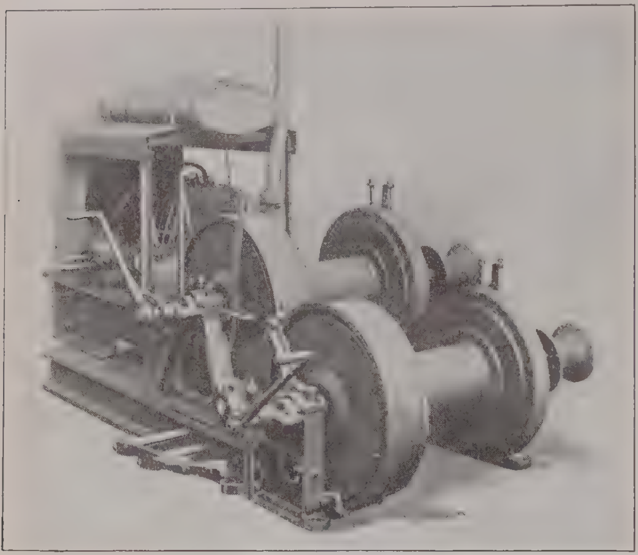
Taking concrete from the mixer to the forms is a little job for which the Northern Conveyor & Manufacturing Company has designed a special machine. Savings of thirty to eighty cents per cubic yard are said to have been made by means of this method of placing by means of the new machine. The conveyor is of the portable belt type and can be readily moved about the job as required or moved to the next work when the job is completed. I said to be particularly efficient on a large job where forms are not too far above grade and where labor is none too plentiful. It picks up the concrete as it is discharged from the mixer and takes it up to the form itself or to a hopper, from where it can be distributed by another conveyor or by means of buggies. It also makes a good truckloader.

Here is the new conveyor taking concrete from the mixer to the work on a tunnel job. Notice the dry mix being used.

Gasoline Hoists

Almost any contractor handling concrete work has use for hoists, and many are interested in those exhibited this year at the road show.

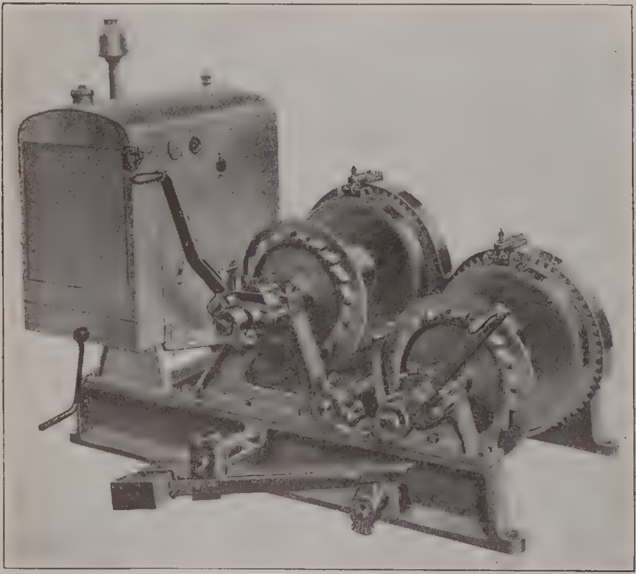
A newly redesigned outfit shown this year is to be seen in the space occupied by the American Hoist and Derrick Company. The chain drive has been discarded and the new gear drive has been adopted. The new hoists are driven by means of spur and bevel gears, with an intermediate longitudinal shaft placed at right angles with the pinion shaft, which is the same as the crank shaft on a steam hoist. The gasoline engine is mounted lengthwise of the hoist. The pinion shaft has a bevel gear near its center which engages with a bevel pinion on the end of the intermediate longitudinal shaft. On the other end of this shaft is a spur gear which engages with the pinion on the engine crank shaft. The intermediate shaft is mounted at nearly the center lengthwise of the bed and is supported by heavily babbitted boxes. The entire hoist and engine is mounted on a cast iron bed plate, thus insuring perfect alignment and rigidity. The drum system is of the unit type of the entire line. Drums may be added to the original assembly as required, thus making a very flexible unit. The same concern is displaying a new gasoline shovel, crane, and dragline combination that is attracting a bit of attention.



The new gear drive hoist just announced by the American Hoist and Derrick Company.

Another interesting series of gasoline hoists is that displayed by the Clyde Iron Works Sales Co. of Duluth, Minn.

The hoists shown are the 15, 35 and 60 horsepower gas units. The 15 horsepower hoist is of the double drum type, incorporating many new features designed to fit all the needs of contractors. The 35 horsepower hoist, as well as possessing all the features of the 15 horsepower hoist, is larger, being equipped with a special Waukesha motor. The 60 horsepower hoist, which is to be displayed, has three drums in the waterfall arrangement, together with a bull wheel swinging gear. This machine is especially designed for operating a clam shell bucket, but can be used for any other derrick or hoisting operation.



The Clyde 15 h.p. gasoline hoist of the double drum type, which contains some improvements.

In addition to the foregoing, the Clyde is displaying for the first time, a new style electric Capstan Carpuller. This unit is of an entirely new design, and is creating much interest.

Tractors

Several interesting tractors are to be seen. A new one is on display at the Cleveland Tractor Company's exhibit at the Coliseum, which is devoted to a display of the Company's new industrial crawler tractor—The Cletrac Model "K," 15-25 H.P.

In addition to showing the tractor and a cut-out motor, numerous separate units of design will be displayed. The latter will include a complete transmission assembly with power take-off attachment, a side frame, together with a lower track wheel and shaft disassembled so as to point out the plain bearings with which the wheels are equipped.

The new model "K" tractor introduced this month by the Cleveland Tractor Company.

One of the advanced features of design found in the Model "K" is the lubrication system which provides for the oiling of the lower track wheels direct from the driver's seat while the tractor is in motion. This is accomplished by the instantaneous oiling system operated by a hand plunger located directly in front of the driver's seat. The new tractor is said to deliver 90% of its total weight in draw bar pounds pull.

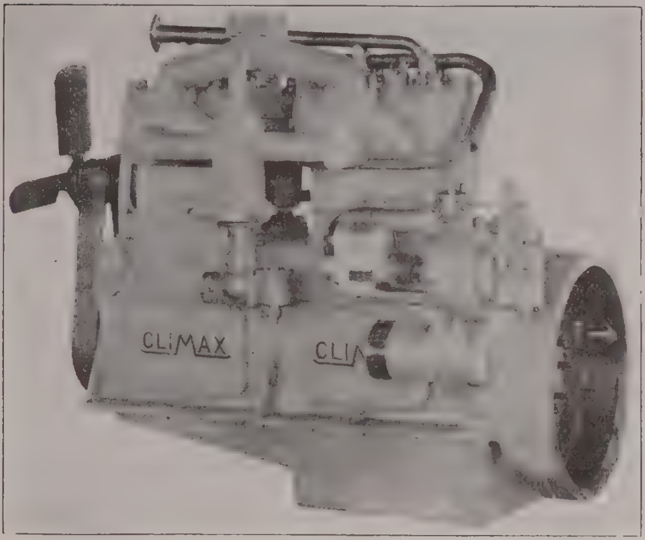
Gasoline Engines

The Climax Engineering Company have a complete line of engines at the Show. Each of their various series are shown as bare engines, or as Portable Power Units.

It is one of several such displays that give road equipment users a splendid idea of the engines that are found in the wide range of machinery using such power.

The new "R" series Climax engines are shown in two models — a four cylinder and a six-cylinder. Both these models have a 6 in. bore and a 7 in. stroke and are of the enclosed flywheel type with ledge mounting. At 1200 R. P. M., the B. P. H. for the six cylinder engine is 132; for the four cylinder, 92.5.

The "R" series engines are equipped with water circulating pump, water outlet manifold, dust proof priming cups, built-in governor, belt driven cooling fan, and cylinder heads built to hold two spark plugs per cylinder. A dual ignition system is recommended for this type engine. This consists of a Bosch magneto and Bosch distributor and coil, synchronized so either or both may be used at the same time.



The new Climax Series R engine, a four cylinder job, that is of the modern type demanded by the contractor.

Among the other models on display are their "TU" engine, which is a very popular size for road equipment. This is a four cylinder engine, having a 5½ in. bore by 7 in. stroke and a horsepower range of 50 to 75. The piston displacement is 665.0 cubic inches.

The engine is equipped with water inlet pipe, water circulating pump, dust proof priming cups, Climax built-in governor, and gear driven cooling fan.

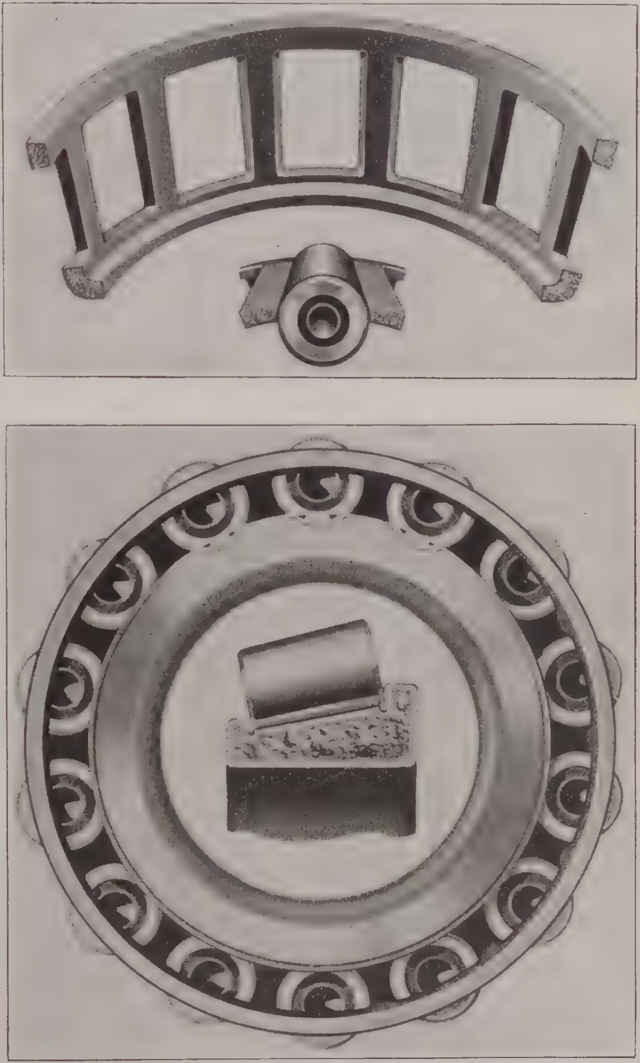
They are also showing their Model "KU" engine mounted and equipped as a Portable Power Unit. This engine has four cylinder, 5" x 6½", with a piston displacement of 501.4 cubic inches. It develops 57 B.H.P. at 1200 R.P.M. and at 900 R.P.M. its normal horsepower is 48.

Pumps For Contractors

On a great deal of work a pump is needed to keep the water away from the forms, and there are cases when a pump of the kind just introduced by the Humphreys Manufacturing Company, of Mansfield, Ohio, comes in handy. This new pump, recently added to their line comes in both the diaphragm and plunger types. They appear to be well built and portable units, and are said to be able to work efficiently with a lift of 25 or more feet. These new lift and force trench pumps, have been proving successful on a number of jobs. They are equipped with LeRoi engines and are made in 3 in. and double 3 in., and 4 in. and double 4 in. sizes, with capacities ranging from 50 to 220 gallons per minute. The diaphragm type is intended for low pressure work where the water contains a high percentage of solids, while the plunger type works at higher pressures and cannot pass as much silt and gritty matter.

Roller Bearings Popular

The observer particularly notices, this year, a growing popularity for better mechanical features on all equipment. The increased efficiency that comes of better design and better construction, as has been observed during past years by every user, has more than ever prompted contractors to demand and manufacturers to produce better and better machines each year. One feature that has been growing in use appears to be the roller bearing. This reducer of friction losses is well exemplified in the booth occupied by the Timken Roller Bearing Company, of Canton, Ohio. Besides illustrating the recent improvements that have been made in their popular product, this concern is showing a model of their steel plant, in which the material is made that goes into their bearings. In improving the Timken bearing a new nickel-molybdenum steel has been developed that possesses, it is said, better grain texture, toughness, hardening, heat treating, and machining properties. This feature should add greatly to the life of the bearings. The roll has been changed so that the surface of the large end presents a right angle relation to the center line of the roll. The contact then between the large end of the roll and the rib of the cone is in two areas, the rib of the cone being slightly undercut. This insures perfect alignment between the center line of the roll and the center line of the bearing at all times, and insures perfect line contact between the surface of the roll and the surface of the cone,

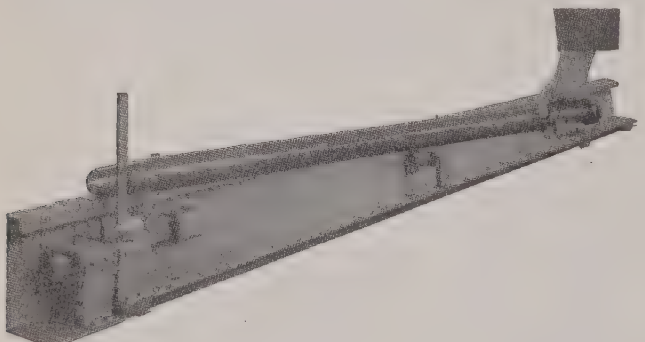


Assembly of new Timken bearing, with view of the new cage, and other details.

and between the surface of the roll and the surface of the cup. The cage has been made more accurate in perforation by a change in manufacturing process and by a slight change in shape. This perfected bearing is said to have a longer life, to be more quiet in running, and to insure more perfect alignment, and to be mechanically perfect and better built in every way. The manufacturers claim a still further reduction of their hitherto unusually low coefficient of friction, because of these changes. At the same time the essential characteristics of the Timken bearing are retained.

Road Forms

The Truscon Steel Company, Youngstown, Ohio, is showing their new road forms that have recently been introduced. These steel forms are made of $\frac{3}{16}$ in. new billet open hearth steel throughout and all connections are securely riveted. The top flange is 2 in. wide with 1½ in. return, providing a good track for the finishing machine, etc. A special staking provision provides for correct alignment with easy withdrawal. Sliding end points of special design insure additional rigidity and perfect alignment. These forms are a greatly improved product and should prove of interest.



The Truscon road form with stake being withdrawn by means of the special stake puller.

Curb Forms

Another interesting development in steel forms is the new Metaform curb and gutter forms, on display in the space allotted to the Metal Forms Corporation, of Milwaukee. This is a newly designed setup that is quickly fastened together and staked down and that is as easily shifted along the street as the work progresses. It comes in ten foot sections made of 10 gauge annealed steel, and each consists of two side rails, one face rail, and two division plates. A simple set of clamps and wedges provide rapid locking and unlocking, while heavy end boxes lock the abutting forms together without the use of complicated devices. Steel stakes, each with a steel locking wedge, provide good anchorage.

Compressed Air Tools

Compressed air tools and compressors for operating them are well represented. One concern, the Sullivan Machinery Company, of Chicago, has several new things of interest to the contractor. Two new concrete breakers, both of which are substantial, all steel, tools with the regular Sullivan spool valve, are on display. One is a large tool for heavy duty, while the other is a smaller tool for the lighter job. Then there is a compressed air drill sharpener that has been specially designed for the contractor. This machine, which weighs 1,100 pounds and occupies a floor space of only 22 by 26 inches, is said to be very economical of air, but is reputed to be very efficient at making and resharpening hammer drill bits by hammering. It is made to be taken out on the job, in order that work will not have to wait for drill bits. The same concern is showing their portable Turbinair hoist, their electric hoists, and the compressor that they brought out last year.

Testing Machines

With the growing practice of field control of concrete, both on highway and on building construction the matter of a good testing machine is one of importance to the engineer and even to the contractor. When the job is far from an established laboratory a great deal of time can be saved by the installation of a small set of laboratory devices right on the job.

In order to meet the need for a small compression machine the Riehle Bros. Testing Machine Co., of Philadelphia, has developed a new machine and is displaying it at the show this year. This is a 20,000 pound capacity compression machine, hand operated, for testing 2 in. by 4 in. concrete cylinders, and is arranged so that the weighing system automatically ceases to function the instant the specimen breaks. This registers the exact breaking load so that it may be observed in spite of possible inattention by the operator. New style bronze gang molds for 2 in. cylinders and for the standard briquette, together with rolled steel molds for larger cylinders will be shown. A new compressometer for measuring compression and extension in concrete has been developed, and is said to be a great advance over older models.

Aggregate Producers Appoint Stanton Walker as Engineer

The National Sand and Gravel Association has announced the appointment of Stanton Walker as head of their newly-organized engineering and research division.

Mr. Walker has been engaged in researches in concrete and concrete materials for the past 8½ years under the direction of Professor D. A. Abrams, as a member of the staff of the Structural Materials Research Laboratory. He played an important part in the researches carried out at that Laboratory and in the preparation of their published reports.

During 1923, he was assigned by the Laboratory to take charge of the field tests of concrete carried out through the cooperation of the Joint Committee on Standard Specifications for Concrete and Reinforced Concrete, the U. S. Bureau of Standards, the Associated General Contractors and the Portland Cement Association to obtain information on the practicability of the recommendations of the Joint Committee concerning the provisions for control of the quality of concrete in the field. These tests were carried out during the construction of a building for the Victor Talking Machine Co., at Camden, N. J., five large reinforced concrete buildings in New York City and piers for the Newark Bay Bridge of the Central Railroad of New Jersey.

Mr. Walker is a graduate of the College of Engineering of the University of Illinois, where he was also employed by Professor Talbot as student assistant in the laboratory of Theoretical and Applied Mechanics.

He is author or co-author of several papers treating of various phases of concrete work.

At a meeting of the National Board of Jurisdictional Awards, held in Washington, D. C., in November, it was decided to reaffirm the previous decision awarding the placing of reinforcing rods to the structural iron workers. Evidence presented failed to bring about a different award on this material.

Specifying by Water-Ratio in Practice

McMillan and Walker* Discuss Recent Experiences With This Form of Strength Specification on Building Construction Before Montreal Meeting of Engineers—How It Benefits the Owner, the Architect, and the Contractor —A Suggested Specification

At the recent meeting of the Structural Division of the American Society of Civil Engineers, held in Montreal, one of the interesting papers read was on the subject of the Water-Ratio Specifications for Concrete, prepared by F. R. McMillan and Stanton Walker, engineers for the Structural Materials Research Laboratory.

In this paper, the authors point out the need for a specification which will make the field practice of concrete construction accord with the advanced knowledge from laboratory investigations and at the same time form an equitable basis for a contract. The paper embodies a specification which the authors believe fulfills these requirements.

The specification is based on the now quite generally recognized principle that the strength of concrete is definitely determined by the proportion of water to cement in the mixture, so long as the concrete is plastic and workable and contains only aggregates that are clean and of sound and durable minerals.

The numerical relation between strength and the amount of mixing water used by the authors as the basis of their specification is that first given by Prof. Abrams in Bulletin 1, "Design of Concrete Mixtures" of the Structural Materials Research Laboratory and reproduced in Fig. 1 below. This diagram is based on about 6,000 compression tests of 6 by 12-in. concrete cylinders at 28 days, covering mixes ranging from neat cement to proportions of 1 part cement to 15 parts aggregates, consistencies from stiff to very sloppy, and aggregates of a wide range in sizes. The authors point out that many later tests by Prof. Abrams have shown practically the same numerical relationship, while some have shown similar curves but with different constants in the equation.

The paper also points out that other desirable properties of concrete such as resistance to wear, flexural strength, bond resistance, impermeability and resistance to destructive agents, etc., are generally found to increase with increase in compressive strength. Thus, the water-ratio is a measure of more than the strength and is a suitable basis for a specification.

The specification given in the paper was being used on a building at the time the paper was written and the authors give some of the experiences with its use.

The principal provisions for the quality of the concrete are embodied in the requirements for water-ratio and workability. Two grades of concrete are provided. For one, where a strength 2900 lb. per sq. in. was required, a water-ratio of 6 U. S. gal. of water for each sack of cement (94 lb.) is specified and for the other, where a strength of 2000 lb. was required, 7½ gal. for each sack is specified. The specification states:

> "These water-cement ratios are the maximum permissible. The mixes shall be proportioned for somewhat lower ratios so that with the normal fluctuations, which may be expected from batch to batch, these ratios will not be exceeded. Water or moisture contained in the aggregate must be included in computing the water-cement ratios. Water absorbed by the aggregate in a period of 30 minutes may be deducted in computing the water-cement ratio.
>
> "The water-cement ratios specified shall not be changed except by the Architect. In the event the Architect finds it necessary to change the water-cement ratios from those specified, adjustment, covering amount of cement and aggregates affected, will be made as an extra or a credit under the provisions of the contract."

The aggregate proportions are controlled by the requirements for workability. In the language of the specification:

> "The proportions of aggregates to cement for concrete of the water-cement ratios specified shall be such as to produce concrete that can be puddled readily into the corners and angles of the form and around the reinforcement without excessive spading and without undue accumulation of water or laitance on the surface. In no case shall concrete be placed which shows a slump exceeding the following limits:
>
> For Caissons.......Max. Slump 4 in.
> For Heavy Walls,
> Slabs and Beams..Max. Slump 7 in.
> For Thin Walls
> and Columns ....Max. Slump 9 in.
>
> "The proportion of fine and coarse aggregates shall be such that the ratio of the coarse to the fine shall not be less than 1 nor more than 2, nor shall the amount of coarse material be such as to produce harshness in placing or honeycombing in the structure. When forms are removed, the surface and corners of the members shall be smooth and sound throughout."

The specifications contain a requirement that the method of measuring moisture in the aggregate shall be such as to give results within 2 lbs. for each 100 lbs. of aggregate; also a requirement that the aggregate source shall be such that the material received for any one day's operation will be uniform as to quality and grading. It is provided that tests be made during the progress of the work to show the quality of concrete being produced.

The provisions of the specifications covering materials, mixing and placing follow in general, those of the Joint Committee except that the grading requirements of the aggregate are somewhat more liberal, the theory being that with the quality of the concrete fixed by the water-ratio, the question of grading is largely one of economy, and the contractor's concern as to the cement factor may be depended upon to prevent the use of extremely poor grading. The fine aggregate is limited in coarseness to a maximum fineness modulus of 3.50.

---

*F. R. McMillan and Stanton Walker, Associate Engineers, Structural Materials Research Laboratory, Lewis Institute, Chicago, Ill. (Mr. Walker has since become Engineer for the National Sand and Gravel Association, Washington, D. C.)

The authors claim the advantages of this form of specification are that the quality of the concrete is specified on a scientific basis and that uniform strength is definitely assured, regardless of changes in requirements of workability or in the size and grading of the aggregates. Also, it eliminates a source of friction between engineer and contractor, for if a more plastic mix is desired, it is not obtained at the expense of strength by the addition of water, but by changing the aggregate proportions which the contractor pays for in the increased cement factor.

The authors point out that the variation in moisture content in the aggregate (which has been raised as an objection to this form of specification, since the water added to the mix must be corrected for this moisture) has not been a serious obstacle, for the normal condition is that the moisture content varies but slightly from day to day.

Another objection that has been raised is the difficulty of estimating in advance the quantity of cement which will be required. While the authors have included in the paper, a very interesting compilation of data which should prove useful for this purpose, they point out that only a few trials, or a little experience would be necessary to make the usual tables of quantities or previous experience applicable.

Concrete Products Association Changes Convention Place

The annual meeting of the Concrete Products Association, originally slated for Cleveland, will be held in Chicago, February 25 and 26, at the Hotel Sherman. This change in the plans, recently announced, was made by the Convention Committee upon the request of a number of members who were planning to attend the 22nd annual convention of the American Concrete Institute at the same place during the same week.

While the convention was at first slated for Cleveland, at the request of a number of Ohio members, the Convention Committee found that it would be possible to best serve the members by arranging an interlocking program with that of the American Concrete Institute. This will make possible a coordination of the meetings of the two organizations for the best interests of all concerned, will make for an exchange of ideas and experiences that will be worth while, will afford concrete products men the opportunity to attend both meetings for the cost of one, and will assure the members the reduced railroad fares made possible by the larger convention.

Another advantage is that the change will prevent some interference that would otherwise have been caused the Ohio association with their meeting in Toledo.

This idea of meeting in Chicago at the close of the American Concrete Institute convention is one that will mean much, not only to the Concrete Products Association but it should benefit the Institute as well. The programs will be so arranged as to give the technical side of plant operation during the Institute meetings and the business side in the sessions of the products organization. It will increase interest, increase attendance, and decrease expense. Everyone interested in the manufacture of better products, lowering operating costs, or increasing sales is invited to be present.

According to what is being said, the greatest thing that will come before the meeting of the products manufacturers is the matter of more effective and profitable merchandising. Men who have been successful in selling their products will tell how they did it. Other topics of greatest importance to the industry will be discussed. It will be a program that no manufacturer can afford to miss.

The Economic Value of Reinforcement

By C. A. HOGENTOGLER
Highway Research Board, National Research Council

Presented at Fifth Annual Meeting, Highway Research Board of the National Research Council at Washington, D. C., Dec. 3 and 4, 1925.

The following is a summary of conclusions on the investigation of the economic value of reinforcement in concrete roads, covered in an extensive paper presented by the author at the recent meeting of the Highway Reseach Board.

1. The amount of cracking and subsequent disintegrating is a function of time; thus, the rate of cracking is a measure of the life of the pavement.
2. The data shows that steel reinforcement reduced the rate of cracking and thus increased the life of the pavement. This applies both to concrete pavements and other pavements laid upon a concrete base.
3. Crack reduction is more economically accomplished by the use of steel reinforcement than by additional thickness of concrete.
4. A greater reduction was afforded by small steel members closely spaced than by larger members wider spaced.
5. Increasing weight of mesh from 25 to 56 lbs. per 100 sq. ft. considerably reduced cracking.
6. Mesh reinforcement, 25 to 56 lbs. per 100 sq. ft., reduced cracks 35 to 70% in pavements of like thickness.
7. Mesh reinforcement, 25 to 56 lbs. per 100 sq. ft. and bar mat reinforcement 64 pounds per 100 sq. ft.—25% longitudinal—reduced cracks more than one additional inch of concrete, but one additional inch of concrete reduced cracks more than bars (42 to 48 lbs. per 100 sq. ft.) placed transversely only.
8. With good crushed stone aggregate, 56 lbs. per 100 sq. ft. mesh reinforcement, or 170 lbs. per 100 sq. ft. bar reinforcement, 50% each way, caused a reduction in combined transverse and longitudinal cracks equal to that indicated for 2 inches additional center thickness.
9. Mesh reinforcement of 38 lbs. per 100 sq. ft. has been effective for a thin layer of concrete laid as resurfacing upon an old concrete road.
10. One additional inch of edge thickness reduced corner cracks more than mesh reinforcement 25 to 56 lbs. per 100 sq. ft., or 3/8 to 3/4-in. bar reinforcement, but progressive destruction following the appearance of corner cracks was arrested by steel reinforcement.
11. All types of steel reinforcement across cracks tended to hold together fractured slabs.
12. Bar reinforcement across transverse joint, without proper provision for slippage and clearance, resulted in breakage and subsequent expensive repairs.
13. For long slabs, 75 to 100 feet or over, edge bar reinforcement with continuous bond caused corner cracks if the area of steel exceeded 1/4 sq. in.
14. A remarkable agreement was found to exist between results of observations on roads in service and results furnished by a wide range of experimental roads and laboratory tests.

The recent construction projects reported by Trade Commissioner Lynn W. Meekins, Ottawa, include the erection of a 70 room hotel at an estimated cost of $260,000, a two year construction program, costing $1,000,000, and the erection of a bank building at a cost of $600,000.

How Portland Cement Prices are Governed

Increasing Mill Capacities Beyond Possible Consumption Eventually Leads to Higher Prices

"Portland Cement Prices" is a subject which is not fully understood by many consumers notwithstanding the fact that many articles have been published in magazines and newspapers, and books on the subject have been written and reviewed in the recent past.

Frequent inquiries are received by Concrete on how and where to buy cement most economically. The following article explains in general the relation between mill costs and prices, and gives some facts of interest to consumers and particularly to taxpayers in the State of Michigan.

Mill Costs and Prices

Although quotations of cement prices have recently been based upon the sack as a unit, statistics as to production, shipments, etc., still refer to the unit as the barrel, which is taken as four sacks of 94 pounds each, or 376 pounds.

It has been pointed out that prices per barrel of cement to the consumer naturally differ from the net mill prices because they must include the following:

1. Refundable charge for package of 40c to 60c per barrel of four cloth sacks.
2. Freight from the mill to destination, ranging from 25c to a dollar or more, with the average about 50c per barrel.
3. Cost to dealer of unloading, hauling, warehousing, reloading and delivery to customers.
4. Dealer's profits.

In the cement industry, as in every other industry, the costs of making and distributing the product are the biggest elements in determining market prices. The cost of cement is made up principally of labor, freight rates, coal, limestone, shale and other raw materials, and labor is the large factor in the cost of coal, limestone and shale or clay.

In stating the reasons for its sales policy, one of the large cement manufacturing companies recently referred to the conclusion sometimes drawn that the uniformity of price of cement at any one time in any one place indicates some collusion or artificial obstruction instead of being the natural result of economic conditions. In merchandizing cement, the most important condition is competition. The weight and bulk of portland cement, as well as its low price (about ½ cent per pound at the mill), places a limit on the distance in the direction of another producer that it can be shipped at a profit. The most important merchandizing factor is the fact that all portland cement is manufactured and sold under one standard specification used by the U. S. Government, the American Society for Testing Materials, American Society of Civil Engineers, and others. This standard specification sets a minimum requirement which must be met or exceeded by all cement, placing all brands on an equal footing with regard to *minimum* quality.

As the buyer of cement is interested only in the price delivered where he wants it, quotations are given on cement delivered f. o. b. the consumer's town. The demand of buyers that they know definitely the price of cement delivered has led to the practice of quoting the prices in this manner, thus relieving the customer of all annoyance and error in computing transportation costs.

Freight rates, which constitute in excess of 25% of the average delivered price of cement, are the same to any and all individuals, and existing rates between known points on any commodity, such as cement, are public information.

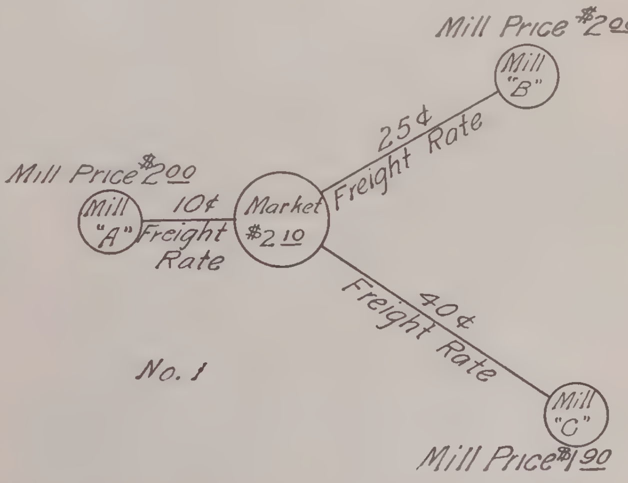
The sale of cement is therefore largely dependent upon:
The reputation enjoyed by the manufacturer;
The activity of his organization;
The service rendered his customers; and
The delivered price of the product.

The price quoted the cement buyer by the manufacturer is influenced by two factors:

First, the base price plus freight charge from his mill to the consumer's town or second, a competitor's base price plus the freight charge from his mill to the consumer's town.

In the first instance, the base price is the *maximum* return the manufacturer receives. even in those towns which, due to their location, enjoy a lower freight rate from his mill than from a competitor's mill. In the second instance, as the manufacturer cannot get more than his competitor's price, he quotes a price which he expects will be identical with that asked by his competitor whose lower freight rate gives his product the advantage at this point.

Past quotations on cement are learned from newspapers, from trade publications, through contact with cement buyers, and other sources. By deducting the known



No. 1

transportation charges, any competitor's price at the point of production can be determined. It is equally simple to anticipate the competitor's price at any definite point by a knowledge of freight rates, and this usually results in identical quotations being submitted by several manufacturers at a given time and place.

The accompanying diagrams reproduced from *Cement Prices,* issued by a cement company, are based on a chart published by the Realestate News Company of Chicago. They illustrate the manner in which competition in a given market levels the delivered price of all cement at that point, even though the resulting business is more attractive to one producer than to another.

Cement mills operating at *A, B* and *C,* seek a common market. *A* has a mill base price of $2 and a freight rate of 10c, or a delivered price at the market of $2.10. As this is lower than the mill-price-plus-freight-rate of either *B* or *C,* the latter must meet *A*'s prices if they wish to sell in that market.

While *A* receives his full mill price for cement at that market, *B* must accept *A*'s delivered price, less *B*'s freight, or $2.10 minus 25c which equals $1.85 at his mill. On the same basis *C*'s mill price for that business becomes $2.10 minus 40c or $1.70.

As *B* or *C* can not get more for their cement than does *A,* they ask, if they desire the business, a price identical with *A's,* causing them to accept less than their *established* mill price.

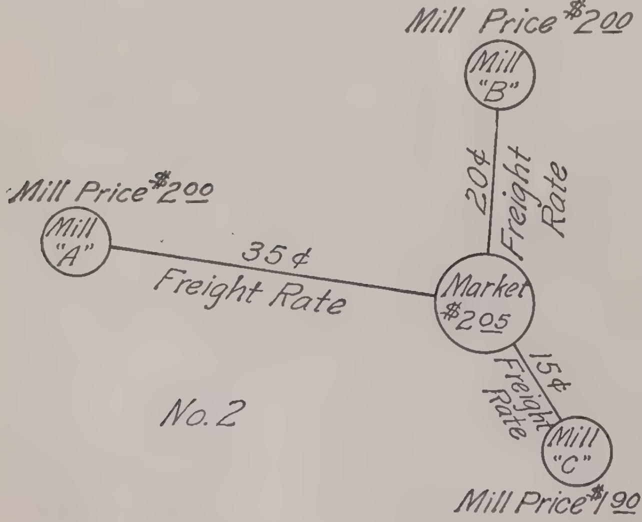
It is also evident that were it not for *A*'s competition, the delivered price would be 15c higher, influenced by *B*'s mill price plus freight rate. In a like manner, if *C* were the only manufacturer serving that market, his mill price plus his freight rate would establish a delivered price 20c higher than when meeting *A*'s competition.

Further, as the competitive market approaches a producing point other than *A,* as illustrated in the diagram number 2, the delivered price changes under the influence of the mill having the lowest mill-price-plus-freight-rate to that point. In this instance *C* has the advantage and *A* and *B* must sacrifice in order to compete.

Scores of such markets must be sought in order to dispose of a mill's output. The manufacturer's net return ranges from the upper limit, or mill price which he himself has set, to the lowest price he will accept for his product.

Michigan Cement Situation

The situation in the cement industry in Michigan is unique, and cement manufacturers who are *actual producers* and not stock promoters realize the seriousness of the condition. There are sixteen producing cement plants in Michigan with a production of approximately 16,000,000 bbls. of cement a year; there is also available for Michigan consumption, 4,000,000 bbls. of cement produced outside of Michigan. The highest consumption in any one year to date was 9,000,000 barrels. The present available annual mill capacity for Michigan is 100% greater than the peak year's consumption while the mill capacity of the country as a whole s 40% greater than the peak year's production, and probably 60% greater than the peak year consumption.



No. 2

With one exception, there are no Michigan cement plants shipping substantial quantities of their product out of Michigan. The one exception is the Huron Portland Cement Co. which has distributing plants at Alpena, Milwaukee, Duluth, Detroit, Wyandotte and Cleveland, served by water transportation. By means of rail and water the cement is shipped as far west as Montana and south into Ohio.

According to price statistics averaged from six cement plants in Pennsylvania, Texas, California, Indiana and Minnesota, the price of cement has been reduced during the past year an average of 3% in those states. In Michigan the price of cement was voluntarily reduced 25c per bbl. within the past year, or about 11%. A reduction of 5c per bbl. was made on February 25, 1925, by the Huron Portland Cement Co. and the Wyandotte Portland Cement Co., both affiliated companies, whose quotations govern cement prices in Michigan. On October 21 a further voluntary reduction of 20c per bbl. was made by the same companies, and like reductions in price were thereafter made each time by other cement companies competing in that territory as a matter of competitive necessity. The basic price of Huron portland cement at Alpena, as of December 15, 1925, to consumers, was $1.75 per bbl. including dealers' and cash discounts, and at Wyandotte $1.90 per bbl.

With the present cost of $3.00 to $3.50 per bbl. of annual capacity of building a modern portland cement plant and a basic mill price of $1.65 per bbl., the net capital involved is not turned over once in two years, showing a striking contrast with other industries where the invested capital may be turned over several times in one year.

The State of Michigan operates a leased cement plant which furnishes only a part of the State's requirements for cement to be used by the State Highway Department, and which has never been a factor in the reduction of the price to the public in Michigan. Reductions in Michigan have been brought about by the real cement producers and are due to the higher peak of production that has been reached and to stabilize production costs, and are not due to any State action.

Cement is a highly scientifically manufactured product and none is imported into Michigan at a high cost which might otherwise be considered as justifying the State in competing with cement companies within the state in its production. Michigan's State cement plant is operated by prison labor and was not an important factor in the cement industry of the State before it was taken over.

No matter what the actual operating costs are, the taxpayers of the State, including the cement companies, pay the bill.

It has been suggested with respect to the State plant in South Dakota, about which there has been much discussion and which has been referred to as a "political football," that the people of the State should keep in close touch with the actual conditions and that a law requiring a quarterly audit must be enforced and the results published for the benefit of the taxpayer. Deductions made by the press are in many instances the only source of information available to the public and whether or not the Michigan State cement plant is being operated at an actual profit from the taxpayer's standpoint could be determined by an unbiased fact-finding commission with power to demand complete data. Whether or not Michigan's State cement plant is not a political football, or becomes one with future changes of administration, the fact is quite evident that it has never been an important factor in governing cement prices in Michigan, and no excuses for the State entering the cement business have existed at any time.

It is evident that if the existing cement plants can not operate fully after having increased their capacity the price of cement will have to be revised upward and the cost to the consumer will have to increase proportionately. The earnings of Michigan cement companies are low as compared to other industries, as indicated by the fact that one of the oldest producers in the State has not declared a dividend since 1915—simply because they didn't earn one, and another which has been in operation for many years, declared its first dividend for twelve years during the past year.

Other States considering even remotely the possibility of establishing cement plants to compete with private corporations will do well to look into the records of South Dakota and Michigan, and Michigan taxpayers will do well to inquire into the actual manufacturing costs at the present State-operated plant, and not remain passive and content with politically stated costs by politicians on the State payroll, made for political purposes, and who have nothing invested as individuals, and therefore nothing to lose and everything to gain, and who in many cases are not even taxpayers—or if so, but nominal ones, and who, therefore, contribute but little or nothing to the cost of operating the State and its legitimate institutions, either directly or indirectly, but who do collect a direct salary from the State, "paid by the taxpayers including sixteen Michigan Cement Companies, all of their officers and thousands of taxpaying employees" for undertaking something they know nothing about.

Concrete Products Men of the Northwest Organize

Representatives of the manufacturers of concrete products from Washington, Idaho and Oregon held a meeting in the Multnomah Hotel, Portland, December 11th and 12th.

A committee composed of C. H. Bullen, Pres. Concrete Pipe Co., Portland; D. E. White, Manager Concrete Pipe Co., Seattle; W. F. Paddock, Secretary Peerless Concrete Products Co., Seattle; W. H. Sharp, Manager Longview Concrete Pipe Co. and Earl V. Bull, Concrete Pipe Co. of Ontario, Oregon, was appointed several months ago with instructions to prepare and submit a constitution and bylaws for a Concrete Products Association. The meeting was held in response to the call of this committee.

About thirty manufacturers were present from the three states, and a permanent organization to be known as The Northwest Concrete Products Association was perfected.

W. F. Paddock, Seattle, was elected president; Roy Ward, Portland, first vice-president; W. P. Hews, Yakima, second vice-president; Earl V. Bull, Ontario, Ore., third vice-president and W. H. Sharp, Longview, secretary-treasurer.

The purposes of the new association are to promote the use of and the manufacture of only high quality concrete products through the interchange of information and by the adoption of standard specifications for the manufacture of all products by members of the association. Arrangements will also be provided for the testing of the materials used and of the finished products.

Practically every phase of the industry was represented, including concrete pipe, brick, block, roofing tile, drain tile and many other products, and the organization will fill a long felt need from the viewpoint of both the manufacture and the consumer.

The invitation of W. H. Sharp was accepted and the first annual meeting will be held at Longview, Washington, January 29th and 30th, 1926.

Annual Highway Symposium

(Concluded from page 16)

Less Concrete in Oregon

By ROY A. KLEIN

Oregon State Highway Engineer

During the past year, very little pavement was laid and the same will be true during the coming season in the State of Oregon on account of limitation of finances and for the further fact that we are now engaged in a heavy grading and rock surfacing program on sections of our state highway system in thinly settled portions of the state where rock surfacing is sufficient to accommodate the travel. We are thus opening up at a moderate cost large sections of the state of tremendous scenic beauty which will become a great attraction for tourists during the summer season.

Our present practice in concrete pavement is a seven inch minimum thickness, thickening to nine inches at the edge in a distance of three feet. We use a metal center longitudinal joint, tying the two slabs together with dowels. We use bituminous felt transverse expansion joints.

Need More Information On Road Reinforcing

By W. W. ZASS, Office Engineer

Arkansas Department of Lands, Highways and Improvements

In reviewing the development of concrete road design during the past year, as well as for preceding years, the thought occurs that the question of placing reinforcing steel in pavement slabs is more shrouded in ambiguity than any other phase or feature relating to this type of surfacing and that we have progressed less fully in defining such requisite needs as exist and advancing a rational design for them as is consistent with the development of concrete pavement design as a whole.

Considerable differences in opinion are still advanced as to the possible advantages accruing through the use of reinforcement as well as to the function of such steel in resisting and preventing cracks and further failures of the slab due to the stresses developed by natural and artificial causes. We know the slab is subjected to internal stresses due to curing, that it is subjected to stresses due to temperature and moisture changes and last but not least that it is subjected to severe stresses due to loading.

It is believed that the slab will ultimately be designed to carry reinforcing to meet all these conditions, but in lieu of using a factor of safety of four as in structural work a factor of safety of two or even of one will be used. Also, in designing the steel for wheel loads it is believed that the steel for tensile stresses can be computed for five foot spans, approximately, in either direction, as under ordinary conditions a subgrade failure in support rarely exceeds this dimension.

A. S. T. M. Group Meetings Highly Successful

Testing Materials Committees Accomplish Important Work at Cleveland

A series of meetings of committees of the American Society for Testing Materials was held in Cleveland, Ohio, on October 27, 28 and 29, in which 14 committees took part including C-1 on Cement and C-11 on Gypsum. In addition, meetings were held of the Joint Research Committee of the A. S. T. M. and the A. S. M. E. on the Effect of Temperature on the Properties of Metals, and of the Sectional Committee on Fire Tests of Materials and Construction, functioning under the rules of the American Engineering Standards Committee. The meetings were attended by about 275 members and guests representing the various industries concerned, such as the producers of iron and steel, non-ferrous metals, gypsum, cement and rubber products, the electrical industries and including representatives of the railroads, public utilities, Federal Government, etc.

Committee C-1 on Cement

At the meeting of Committee C-1, three matters of special interest were discussed. The first relates to an intensive study of compressive tests of cement that have been made by Sub-Committee VII on Strength, under the chairmanship of Dr. P. H. Bates, chemist, U. S. Bureau of Standards, Washington, D. C. These tests which, it is estimated, have cost upwards of $10,000, were designed to furnish more information in regard to the following five factors.

1. A satisfactory type of mortar compression test piece;
2. The effect of different percentages of mixing water in producing more uniform strength in the usual types of test specimen;
3. The relation of the strength developed by these compression test pieces to the tensile briquettes, both neat and 1:3 standard sand mortar;
4. The strength developed by both the compression and tensile specimens at 72 hours; and
5. The strength developed by these at 72 hours by accelerated aging.

The entire investigation pointed towards either the modification or confirming of the present A. S. T. M. Tentative Specifications and Tests for Compressive Strength of Portland Cement Mortars (C 9-16 T), and also possibly to furnish data which might assist in devising strength tests which may be completed in less time than the present 7 and 28-day tests. In the past few months the data have been critically analyzed under the direction of Mr. Bates and at the Cleveland meeting Mr. Bates presented the information with a discussion and the statement that Sub-Committee VII will now begin an intensive study of the findings.

In the discussion of Mr. Bates' report it was evident that the committee is alive to the importance of certain discrepancies that have been noted in these and other series of collaborative tests as for example, in the series of tests under the auspices of the U. S. Bureau of Public Roads, reported by the committee last spring.

The Manual on Cement Testing that was offered to the Society at its last annual meeting in June and accepted for publication, was designed by the committee as a step towards more accurately defining the methods of testing cement. The Manual emphasizes those factors which may affect the results of tests and calls attention to less apparent influences which are important but are sometimes overlooked. The Manual has been well received. The first edition of 4,000 copies has been completely exhausted and a second edition of 5,000 copies is being printed.

The collaborative work reported by Sub-Committee VII constitutes a further step to determine what changes or refinements are necessary in methods of testing cement to bring about greater concordance of test results. Certain further tests are being outlined by Committee C-1 having in view this general purpose. The first of these is a study of tests of neat cement mixed to a very wet consistency. The immediate objects of this series of tests are two-fold, first to eliminate variations that are incident to differences in manipulation of test specimens by cement testers and, second, to obtain, if possible, a test which will bear a more definite relation to tests of concrete.

Fineness of Cement

The second matter of interest is a report of progress that was made at the meeting by Sub-Committee III on fineness, on tests that are being made to determine what changes are required in order properly to define the present standard Ottawa sand in terms of the new sieve series produced by Committee E-1 on Methods of Testing.

The third matter of interest discussed at the meeting related to the status of the Society's Standard Specifications and Tests for Portland Cement (C 9-21) as an American Standard, approved as such by the American Engineering Standards Committee. In view of the fact that revisions are being considered in both the specifications and methods of test it is the desire of the Society as sponsor for the specifications, to have Committee C-1 on Cement, with such additions in personnel as may be required, approved by the A. E. S. C. as a sponsor committee, to the end that revisions in these specifications when adopted by the Society may in regular course be approved by the Standards Committee. Committee C-1 discussed this matter at some length and is prepared to make suitable recommendations to the Executive Committee of the Society.

R. S. Greenman, senior assistant engineer in charge of tests, Department of State Engineer and Surveyor, Albany, N. Y., is chairman of Committee C-1 on Cement, and R. B. Young, senior assistant laboratory engineer, Hydro-Electric Power Commission of Ontario, Toronto, Ontario, is secretary.

Committee C-11 on Gypsum

In the interests of the consuming public Committee C-11 on gypsum products has prepared tentative specifications for molding and casting plasters as well other plasters made from calcined gypsum.

The increasing demand for information regarding the use of reinforced gypsum for structural purposes, such as fireproof floors and roofs, has led the committee into research work and tests for the purpose of developing the following:

Check test methods for field inspection use.

The determination of unit and ultimate working stresses for compositions consisting of gypsum and various percentages of aggregate.

The possible adoption of specifications and recommended practice regarding structural gypsum in many of its present accepted forms.

The development of specifications to govern the manner of selecting and preparing for use, test specimens obtained from the construction which are to be tested at the laboratory.

In the foregoing, assistance is being rendered by the Testing Laboratories of Columbia University and the U. S. Bureau of Standards. The Bureau of Standards submitted to the committee for its information data regarding:

The elasticity of gypsum plasters of various mixtures;
The sand carrying capacity of gypsum plasters;
The modulus of elasticity of gypsum and aggregates.

At the next meeting, specifications for structural gypsum products will be prepared in tentative form. It was felt that the present standard specifications for gypsum products, as published by the Society, should be given publicity. The committee felt that the standards set by the American Society for Testing Materials represented, to the consuming public, an assurance of quality not obtainable elsewhere. W. E. Emley, chemist, U. S. Bureau of Standards is chairman and the late V. G. Marani, chief engineer, The Gypsum Industries, was secretary of Committee C-11.

Scope of the Society

The American Society for Testing Materials is a national technical organization made up of some 4,000 engineers, technologists, scientists, etc., having for its function the promotion of knowledge of materials of engineering and the standardization of specifications and methods of testing. The national officers are: President—W. H. Fulweiler, chemical engineer, United Gas Improvement Co., Philadelphia; Vice-Presidents—J. H. Gibboney, chief chemist, Norfolk and Western Railway Co., Roanoke, Va., and H. F. Moore, Professor of Engineering Materials, University of Illinois, Urbana, Ill.; Secretary-Treasurer—C. L. Warwick. Its business is transacted at annual meetings held each June.

Between these meetings the work is carried on by over 40 standing committees who study various materials and carry on tests to determine the properties of these materials so that engineers may know better how to use them, and prepare specifications and tests to govern the interchange of these materials between the manufacturer or seller, and the consumer, or buyer. The committees are made thoroughly representative of both manufacturers and users. Experts who are neither manufacturers or consumers also serve on the committees. In this way the points of view of all three groups are brought directly into contact in an attempt to arrive at standards satisfactory to all parties.

The group plan of holding meetings has worked out very successfully, the recent group meeting at Cleveland being the fourth. By holding the meetings jointly the time of members on more than one committee is conserved in that the members can thus attend meetings of the several committees in which they are interested by making but one trip. The group meeting plan has a further advantage of promoting intercourse among the members and creating an *esprit de corps* and Society solidarity not otherwise obtainable.

Circular Cluster Grain Tanks in Hungary

By E. LEE HEIDENREICH

(BETON U. EISEN, Heft 18)

Even Hungary is adopting American Concrete Grain Tanks for storage. Willy Obrist, consulting engineer in Budapest, has designed an elevator very nearly American in construction, but very un-American in appearance, as may be observed in the cuts Fig.'s 1, and 2 from Beton u. Eisen.

The ground plan is nearly an exact copy of any medium size American flour mill with its adjacent elevator and storage facilities, while the elevation shown in Fig. 2 reminds one of a Grecian temple as much as anything.

Some one has written that the American grain elevators throughout the country give a decided originality to the surroundings of our great grain centers,—why then should not we also make an attempt to beautify these, often tremendous monuments to an important American industry?

All over Europe we find industrial buildings constructed with a fine appreciation of beauty, and really, the additional cost is soon amortized in a psychological way of giving pleasure to humanity.

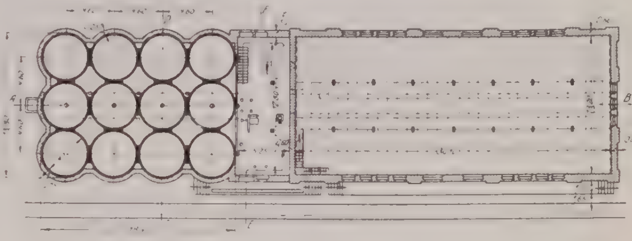


Fig. 1. Ground Plan of Cluster Grain Tanks.

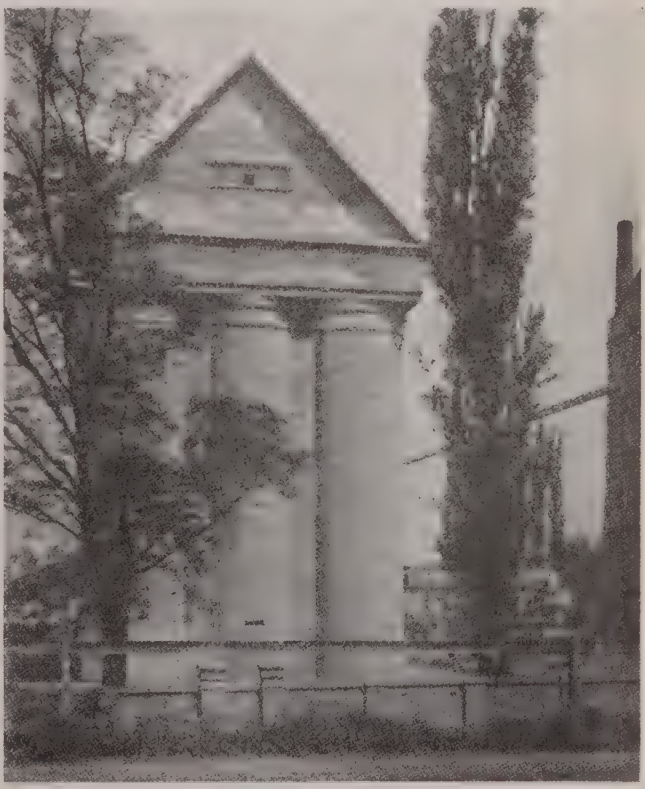


Fig. 2. Elevation, showing attempt at Architectural treatment.

How, What, Where, and When?

"Can you tell me the way to use concrete in putting in window panes of glass? Have seen an item that said if cement was mixed with some kind of oil (I forget what kind) the glass would not fall out. If you have a formula please send it."

C. B——,
Dover Plains, N. Y.

In reply to your inquiry, we can not quite place any information about using cement in glazing windows, but we might suggest that you test out a small batch with linseed oil, and let us know what happens.

We would like to have the answer to this question ourselves.

"At the time my house was built, about a year ago, the contractor neglected to tile drain it. The basement was constructed of concrete blocks. It was plastered on the outside with cement and painted with asphaltum paint. Whether this was done below the level of the grade line, i. e., below the level of the cellar floor, I do not know. After a heavy rain the ground-water begins to seep into the basement, up to the level of the second course of the cement blocks, until it reaches from the walls to the drains. The water, apparently, does not come through the cement floor. At the west end (side) of the house, where the trouble was the worst, I had tile-drains put in at an expense of $128.00, which has improved the situation to some extent but has not entirely remedied it.

"The house is surrounded by a terrace, about 4 ft. high, which is 10 ft. wide at the front and about 5 ft. at the rear and sides. The basement is 7 ft. high.

"Now is there anything further I can do to keep the water from oozing through the cement blocks? Is there anything that I can apply to the basement surface that would have this effect? Please advise me, either in the columns of your valuable periodical or by mail."

H. E——, M. D.,
Birmingham, Mich.

Here is a prescription which seems to fit the symptoms you describe. Either dig a trench around the exterior of your foundation wall, exposing the outside surface of the block down to the bottom of the footing, and apply any membrane waterproofing, or cheaper still, paint the inside of your foundation wall with one of the special preparations placed on the market for this specific purpose.

"Can you give me information as to special mixes or formulae that can be used in manufacturing cement laundry trays?"

C. J. D——,
Portland, Oregon.

We are of the opinion that a 1-2-3 mix would be about right for the construction of these trays. The maximum size aggregate for this use should be about one-quarter inch, and care should be taken that the concrete is extremely dense.

We might recommend that one of the several successful waterproofing compounds should be used in the mix in order that a perfectly watertight job may be secured.

If you desire to obtain a rather ornamental job, you might try one of the specially colored aggregates, such as black, and use mortar color in your concrete. Grinding and washing with diluted muriatic acid will produce a glossy, ornamental surface that should prove easy to clean. Waxing might even be resorted to.

"Will you please procure for me information regarding the round pointed trowel described in the article on Decorative Stucco that appeared in your December issue?"

W. F. R.——,
Denton, Md.

In answer to your inquiry of December 7th, concerning the round-pointed trowel for use in obtaining decorative stucco finishes, we would suggest that you get in touch with the following manufacturers of cement workers' tools:

(Names on request.)

It may be that none of these firms carries the round-pointed trowel in stock, but we understand that it is easily made from an ordinary steel trowel by simply grinding down the point to conform to the desired shape. This could either be done for you by the manufacturer, or you could buy the ordinary trowel and do the grinding yourself, conforming somewhat to the shape illustrated in our December issue.

We understand that the man whose picture is shown using this round pointed trowel actually made it himself from an ordinary one, but the type of trowel you desire may be on the market.

"I have read the very interesting article about the centrifugal process of making concrete columns in the October copy of your magazine.

"Will you kindly tell me what is the approximate speed, with which the mould revolves?"

V. A. G.——,
Milwaukee, Wis.

In answer to your inquiry of November 19th, the available information in this office indicates that revolving forms used in the centrifugal process are speeded up to three hundred revolutions per minute or higher, after the concrete has been inserted.

It is necessary, however, that the forms be revolved slowly when the concrete is being put into them, and then the apparatus is speeded up to the higher rate after three or four minutes.

"We have just completetd two concrete buildings, and there are other buildings coming.

"What can you recommend as a satisfactory dust preventive?

"Some recommend liquid glass, others concrete paint and others diluted linseed oil.

"What can you recommend or tell us about these products?"

Wm. H. H.——,
Troy, Ohio.

Concrete floors can be prevented from dusting in a satisfactory manner by the application of magnesium fluosilicate, sodium silicate, aluminum sulphate, zinc sulphate, and various gums, soaps and paraffins.

We are not in possession of information that will indicate the relative merits of these materials, but understand that magnesium fluosilicate is very satisfactory.

They are all good, however, while a less permanent effect can be obtained by using any standard concrete paint or sometimes, even diluted linseed oil.

The above materials can be purchased through almost any material dealer, or may be secured direct from the manufacturer.

Many men enter into partnership agreements without fully realizing that each is thereby risking all that he owns in case of business failure. That is something that is common of partnerships, say legal authorities. If a man wishes to go into business with the least risk for his personal assets it is better to incorporate, and thus be only liable for the assets of the firm. This is a point to which contractors and products manufacturers should give consideration.

The Road Show in San Francisco

All Western Road Show Held Recently Contained Many Exhibits of Equipment Used in Concrete Highway Construction, and Served Many Builders Who Could Not Arrange a Trip to the Later Show Held in Chicago

At the first annual All-Western Road Show held on the Marina, the site of the Panama-Pacific International Exposition, at San Francisco, November 9th to 14th, there was an exhibition of highway building equipment and materials, which was the first of its kind ever held west of Chicago and which the largest in America, if not in the world.

The event was sponsored by the Western Construction Equipment Distributors' Association representing eleven Western States, but exhibits were entered from manufacturers of highway building equipment and materials in all parts of the United States. It is estimated that nearly $3,000,000 worth of equipment was on display.

In addition to California, the Western States officials represented were Idaho, Utah, Nevada, Colorado, Montana, New Mexico, Wyoming, Oregon, Washington and Arizona.

Five Tents Used

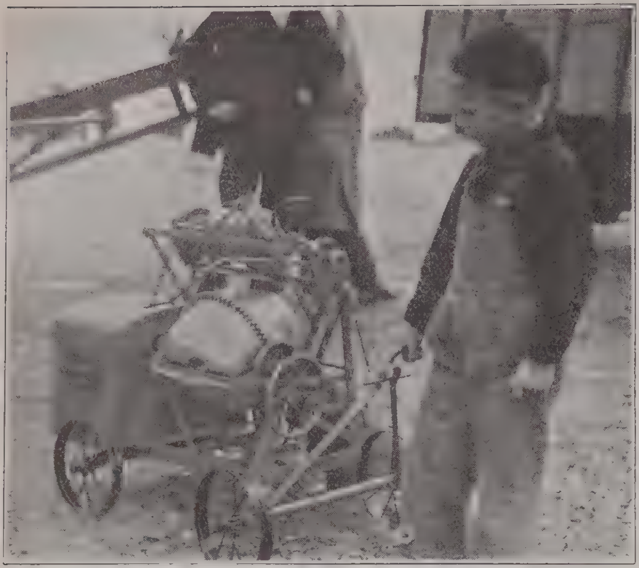
The exhibits were housed in five immense tents, many of the machines being in actual operation under their own power. This was made possible by providing underground pipes which connected with the exhaust carrying the exhaust gases outside the tents. There was also a large demonstration field where equipment was demonstrated under actual working conditions. Without a doubt, the operation of the machines in the tents and on the demonstration field proved its value, both to the exhibitors and the visitors, and created a vivid picture of the enormous capacity and possibilities of the machines, that stationary exhibits can only hint at.

An interesting feature of the Show was the large number of working models, that were found among the displays. Perhaps the most interesting of these models from the concrete builders viewpoint was the smallest concrete mixer in the world, which was brought to the Show by Mr. Henry C. Frass, vice-president of the Jaeger Machine Co., of Columbus, Ohio. This miniature mixer is a complete working replica of the company's 16-foot Model 16, reduced to one-sixteenth of the size of the standard model and is operated by a 1/8 h. p. electric motor. The drum is made of aluminum and has a capacity of one cubic foot.

The exhibit of Smith, Booth, Usher Company, of San Francisco, showing locomotive, shovel, conveyors, loaders, and other equipment.

Some idea of the magnitude of the individual exhibits may be gained by the panorama showing the exhibit of the Koehring Company. This exhibit was in charge of their San Francisco distributors, Harron, Rickard & McCone Company and consisted of a Koehring No. 1 3/4-yard 27 E paver with boom and bucket, a 13-E paver with boom and bucket, a 7-E paver with chute, a No. 10-S heavy duty construction mixer, No. 107-S Dandie mixer, and a No. 1. shovel, this being in operation as shown at the left in the photo.

The Koehring Co. exhibit with its pavers and the gas shovel, which were operated for the benefit of the visitors.



Here is the smallest operating mixer in the world, a working model of the Jaeger machine.

Many Exhibitors

Following is a list of some of the other leading exhibitors of concrete equipment:

Heltzel Steel Form and Iron Company, Warren, Ohio, displayed armor plate steel road forms, with heavy steel pocket lock joints, a new yoke connected curb form, sidewalk forms, straight edge for road work and floats and adjustable stakes.

The Handy Sack Baler Company of Marion, Ohio, demonstrated the Handy Sack holder, and displayed their No. 0 sack cleaner mounted on four wheel truck and equipped with a tongue so that the truck can be attached to the paver or mixer and pulled along to the next location where the equipment is to be used. A No. 00 combination baler with a capacity for cleaning 1200 sacks in ten hours was also on display, as well as samples of baling wire straightened and cut to the proper length to fit either cement or plaster sacks.

The Concrete Surfacing Machinery Company, Cincinnati, Ohio, displayed a Berg portable heavy duty concrete surfacer, a Berg concrete surfacer and finisher, Berg air cushion hammer and electric multiple.

The Lakewood Engineering Company, Cleveland, Ohio, displayed a Lakewood subgrader, and Carr Road forms, Lakewood type 207-S Concrete mixer, Lakewood cars, track and batch boxes, Lakewood tower hopper, chute and clam shell bucket and aluminum straight edge.

The Chain Belt Company, Milwaukee, Wis., exhibited a Rex paver model 21-E with a young lady operating it, a Rex model 14-S, Rex half bag mixer, Rex one bag trailer type, Model 7-S and Model 14-S mixer.

The Construction Machinery Company, Waterloo, Iowa, displayed the tilting Wonder mixers in six sizes.

Norris K. Davis, San Francisco, displayed the 20th Century line of mixers.

The Ransome Concrete Machinery Company exhibited a 21-E. Paver and a tilting type mixer.

The A. W. French & Company, Chicago, Ill., had a crew of men operating an Ord concrete road finisher using sand in place of concrete.

The Blaw Knox Company, Pittsburg, Pa., exhibit included a complete set up of an inundation plant and a complete weighing batcherplant, as well as steel forms for road and street work, etc. This was the first public showing of the Inundation System.

The Kwik-Mix Company, Port Washington, Wis., exhibited a full line of concrete mixers.

The Erie Steel Construction Co., Erie, Pa., displayed an Erie aggre-meter plant of the type used for highway work.

The Marchal-Clausen Mfg. Co., Oakland, California, operated a Clausen batch charger, for charging paving mixers.

The C. S. Johnson Company, Champaign, Ill., exhibited a Johnson automatic weigher hopper and a Johnson automatic volume measuring hopper. The automatic weighing hopper is the result of the California Highway Commission ruling to the effect that sand should be measured by weight rather than by volume.

The E. R. Bacon Company, San Francisco, had in operation a Multifoot 26-E. sack mixer, with a special stairway and platform to enable visitors to inspect all parts of the machine.

Essick & Co., Los Angeles, Calif., exhibited two types of concrete mixers mounted on Ford wheels.

The T. L. Smith Company, Milwaukee, Wis., had a Smith 6 bag gasoline driven paver with boom and bucket in operation and displayed a Smith tilting mixer on wheels.

The Butler Bin Company, Waukesha, Wis., exhibited a batcher for proportioning sand and rock by weight.

The Knickerbocker Company, Jackson, Mich., displayed their 7-S mixer.

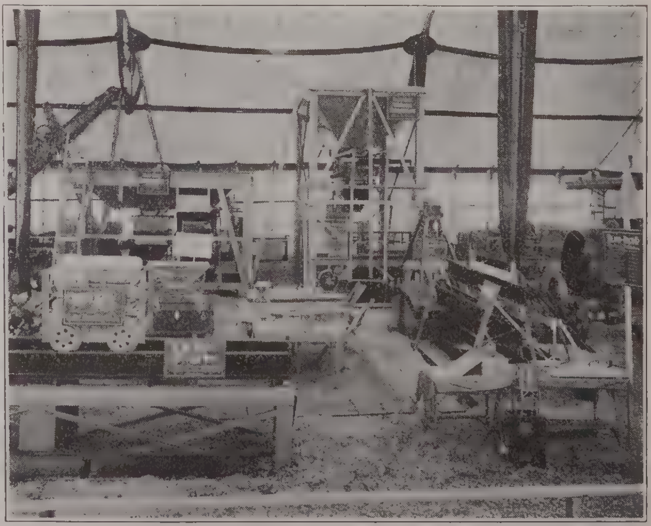
The A. L. Young Machinery Co., San Francisco, exhibited a trailer concrete mixer embodying a spring mounted chassis with solid rubber tires, steel wheels and axle.

The O. R. Peterson Company exhibited a concrete mixer mounted in front of a Fordson.

The Jaeger Machine Company, Columbus, Ohio, exhibited a mixer mounted on a Ford truck and a No. 7-H. 4 mixer with a Jaeger placing plant for placing concrete for bridge construction, swimming pools, etc. There were also displayed two No. 10 pavers with traction drive, one equipped with boom and bucket and the other with spout and batch meter.

In the Portland Cement Association exhibit there were displayed two oil paintings depicting the modern construction of the "Ideal Section" on the Lincoln Highway.

McKiernan-Terry Drill Company, Dover, N. J., demonstrated a miniature working model of a double acting pile driver of the type used in driving reinforced concrete piles and sheet piling.



The Blaw-Knox exhibit featured the Inundation plant, the Batcher plant, and other products.

At the A. C. I. Meeting

Better Ways of Making Better Concrete—New Discoveries and Tests—Better Stucco Demonstrated—Field Control of Mixtures—Better Architectural Treatments—Lime in Concrete Block—and Other Things of Interest To Be Discussed

Would you give four days of your time to discussing better ways of making concrete? Would you give four days of your life to show others how you are making better concrete? Would you devote a half a week to finding out how others are making better and more uniform concrete, possibly at a lower cost? Then by all means arrange to attend the coming 22nd Annual Convention of the American Concrete Institute, to be held at the Sherman Hotel, Chicago, February 23 to 26.

According to the latest news letter of that organization it is probable that two sessions of the annual meeting of the American Concrete Institute will be given over to the discussion of the design and field control of concrete mixtures, the ways and means of good concrete, and to records of the success of such control efforts. Men from the job will tell how unusually good work was done on the Wilson Dam. A Canadian engineer will describe seven years of progress with field control as experienced by the Ontario Hydro-Electric Power Commission. The work on the Pittsburgh Stadium will be discussed by the engineer who had charge of its construction. J. G. Ahlers will present a paper on test data and job control, and will discuss the lessons drawn from the records of this work.

The committee on Destructive Agents and Protective Treatments will present a very valuable symposium reporting significant things in connection with work that had gone bad, or which is none too good, and will assign a remedy for each case, or suggest means of avoiding such ill effects in the future. One unusual case, in particular, will show how a twelve year old job has failed to stand the test of time and the elements.

An evening session of the convention will be given over to things of interest to the architectural part of the field, and to things of craft interest. A great feature of that session will be presented by John J. Earley, who will describe the use of concrete in the replica of the famous Parthenon, recently constructed at Nashville, Tennessee, and on a large group of buildings for the Louisiana State University at Baton Rouge. Stereopticon views will be shown. Then David C. Allison, architect, will present a paper on the design of reinforced concrete buildings, with reference to the complete use of concrete in curtain walls and finish.

Stucco Demonstration

Another unusual feature of that session will be a talk on the new stucco methods as developed in California, presented by O. A. Malone, of Los Angeles. Following his talk, Mr. Malone will demonstrate the application of several modern finish treatments, using both color and texture to obtain the desired effect. This will concern the sort of stucco work that was described in the December issue of CONCRETE. H. M. Hadley will draw some lessons from recent earthquake experiences and will present a paper on reinforced concrete design to resist earthquake shock.

During the remainder of the session will be presented papers and discussions on many other live topics. A. Burton Cohen will present a paper on "Correlated Considerations in Design and Construction of Concrete Bridges." The hows and whys of a good job of terrazzo floor work will be well covered by H. S. Wright. A number of men will discuss the proper detailing of construction when concrete units are to be used. The status of concrete masonry units in building codes will be explained by Frank P. Cartwright, of the Department of Commerce.

Lime in Block

A Paper by P. C. Cunnick, Director of Laboratories, Rock Island Arsenal, will report the tests run at the arsenal to determine the effect of various percentages of lime in concrete mixtures for block. Reports to date have indicated the probability of findings that the addition of considerable percentages of lime to the mix will show increased strength and watertightness, with improvement in appearance, particularly in color.

Concrete stave standards, and the curing of concrete building units will come in for discussion. The latter topic will include preliminary discussion of a current series of tests now under way at the University of Minnesota laboratory.

One session of the convention will be given over to road design and construction. Matters of construction plant, the use of calcium chloride, pavement design, transverse and compressive tests, and other live subjects will be reported on by authorities and discussed from the floor.

One entire session will be devoted to the annual Question Box. Here will be discussed many topics of interest to the man in the field and in the plant, questions that will not come up as formal papers but which will be discussed by all who desire. In the past this feature alone has made it worthwhile for many to attend the convention. It is here that many preplexing problems of making concrete come up, and it is here that many a real solution is discovered for things that have puzzled many men for years.

Latest Tests

Another session will be devoted to the presentation of a number of papers on tests. A. T. Goldbeck will discuss what the most significant tests of concrete may be, while Alfred H. White and John H. Bateman will tell about the use of soaps as waterproofers, Willis A. Slater will present an interesting paper on the relationship of seven day compressive strengths to the twenty-eight day strengths, pointing out the possibility of being able to estimate later strengths upon the basis of compression at seven days. W. K. Hatt will discuss the results of tests to determine the ability of concrete to undergo elongation without fissures, and the effect of curing conditions and small amounts of reinforcing in the control of these surface phenomena. Benjamin Wilk will describe the series of investigations now being made in connection with the erection of a concrete stack at the Duluth plant of the Universal Portland Cement Co. Herbert J. Gilkey will report his findings on a series of tests on the effect of varied conditions of curing. A purchasing specification for aggregates will be presented as a report by Committee E-5, and this will be supplemented by recommended limits for different characteristics of aggregates for concrete for general construction.

Products Sessions

This year, as announced elsewhere in this issue, the annual convention of the Concrete Products Association will be held in the same hotel on dates that overlap the dates of the American Concrete Institute Convention. This arrangement has purposely been made in order that any members of either organization that wish may take advantage of the programs of the other organization, and also to make it possible for concrete products manufacturers to attend both conventions without the time and expense necessary to make two separate trips. The fact that the concrete products industry has grown to the dignity and importance of a recognized industry producing vast quantities of a meritorius product makes it now of greatest importance that products manufacturers interest themselves in the work of both associations. Programs will be so arranged as to present a week of the greatest benefit to all who attend.

Obituary

W. H. Carey, president of the Concrete Products Association, a prominent producer of concrete products in Wisconsin, has passed away. His death, caused by heart disease, occurred on December 6, 1925, at his home in Wisconsin Rapids.

W. H. Carey is dead. He was a big fellow who lived and worked in Wisconsin Rapids, Wis.—a concrete products manufacturer who was an exhorter of the type which has been—and still is—needed in the field of concrete products manufacture. It is easy to think of Carey as a kind of revivalist—of the genial kind, whom it was easy to follow. He believed in, and preached, better concrete and he had that quality of leadership in the trade gospel of his field that won him first the presidency of the Wisconsin Concrete Products Association and then the presidency of the National Concrete Products Association at the time of its reorganization last winter.

While Mr. Carey was identified chiefly with the manufacture of concrete building units, not only of the standard block sizes but special-dimension stone as well, the picture of him shown here, tied him up with a newer enterprise. The pipe seen in the picture are of 42-in. diameter, 4½ in. thick, in 4-ft. lengths, made for a sewer job in the city of Wisconsin Rapids, which required 325 such units, among which there wasn't a single rejection on inspection.

Mr. Carey organized the Carey Concrete Co. in May, 1909, with a capital of $10,000—a year later increased to $15,000. He was president and manager of the company and owned 80 per cent of the capital stock. He was a pioneer in making wet-cast block, employing the Zagelmeyer system, and went into this at a time when "pouring 'em wet" seemed to be the cure for the thirsty block evil. Many units were at that time hammered out of a meally, dry mix, with insufficient cement, not enough water and little or no curing of the proper kind. Since then, of course, we have learned that there are abuses on the side of too much water as there are on the dry side. With intelligence and conscience, block can be made right either way—right enough for all practical purposes. Mr. Carey, however, thoroughly believed in the wet block and justified his belief by making a success of it. He had a new thing to sell in his territory. Buyers, more or less familiar with the thirsty, dry-tamp block which were so common, were prepared to believe in the water methods of the wet-cast system. Entirely aside from the pros and cons of "the wet" and "the dry," Carey was bent from the beginning on a quality product. He would make no other, and he was keen enough to have periodic tests made, so that he had the written word of accredited laboratories to show for what he was doing.

Along with the block, Mr. Carey made trim stone in steel molds of his own devising, so that he was able to be entirely consistent in the kind of manufacturing methods which he advocated. What was good for the block was good also for the trim. The product, too, of a fine smooth surface, has given its users a good deal of satisfaction.

It was in 1923 that the Carey Concrete Co. went into the manufacture of reinforced concrete sewer pipe, first for a home job.

When the Wisconsin Concrete Products Association was organized in 1923 Mr. Carey was unanimously chosen president and was unanimously reelected. The Wisconsin association has been very active and has accomplished a great deal of good in establishing concrete masonry building units on the right basis in the minds of the public. This has been not merely by advertising and united action along that line but by united action in insisting upon high quality in the products of association members, especially through cooperation with the state building department which has fixed the quality of products required.

Mr. Carey was always active in this direction, not only in Wisconsin, but he was an influential factor over even wider territory in addressing state and local organizations where the fame of the work of the Wisconsin manufacturers had spread, and where like undertakings were under way. Carey was also an active member and committee worker in the American Concrete Institute.

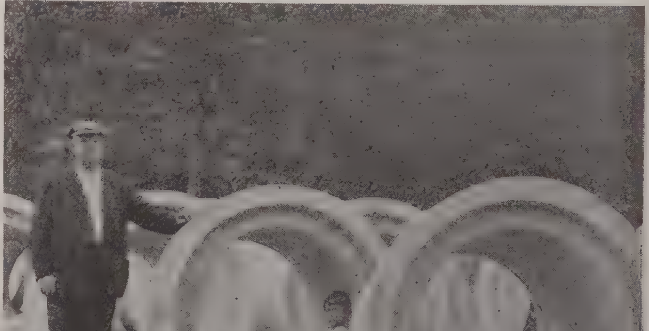


Fig. 1. W. H. Carey and some of his pipe on the job in Wisconsin Rapids.

Safety Measures in Construction

Contracting Firm Plays Up Safety Idea—Some Pointers on Safety Measures in General, and the Protection of Material Hoists — A Bell System That Cuts Accidents

One outstanding feature in connection with accident prevention work which was perhaps emphasized most at the recent Safety Congress of The National Safety Council was the need for definite statistics as to accidents in any industry or branch of industry, regardless of whether it is construction or manufacturing or any other. By studying accidents and their causes, ways of preventing them can be devised. Many times near-accidents or "accidents that do not happen" indicate dangerous points on the job or dangerous operations which can be remedied before serious accidents occur.

A suggestion by one engineer who has had extensive experience on large construction jobs proposed the publishing of a list of the mistakes which have been made and which led to fatalities and injuries, to start a literature of live experience.

Instruct the Men

In accident prevention in the construction field and particularly in concrete construction, the Turner Construction Co. has set a good example. In a recent message to superintendents and foremen in the *Turner Constructor*, H. C. Turner, president, points out that a large number of accidents can be prevented through the example and effort of superintendents and foremen in teaching workmen to be careful. It is cited that in industrial plants, five times as many men are hurt in the first six months of their employment as in a six months' period after they have had five years' experience. This, Mr. Turner points out, emphasizes the importance of instructing new workmen in their duties and of warning them of special hazards.

The Portland cement industry has done much to establish the importance of reporting all accidents and giving all possible details in each case. The system being followed in the cement industry is being adopted in other industries particularly where the value of accident statistics is recognized. The importance of getting the executives of various companies interested in safety work was emphasized, it having been an up-hill struggle to promote accident prevention work among the men on the job without the executives giving their whole hearted support.

That the Turner company is giving the problem of safety in the construction industry very careful study is evidenced by papers by D. H. Dixon, vice-president of the company and chairman of its committee on accident prevention, and by N. L. Doe, general superintendent, in the *Turner Constructor*, extracts from which are included in the following. Mr. Dixon in his general article on reducing the frequency and severity of accidents on construction work, describes very briefly some of the matters that must have the careful attention of a construction organization if the desire to reduce accidents is to be realized "for no problem in connection with construction work requires more careful study by executives and more thorough co-operation by the entire organization."

Plant and Tools

This item is mentioned first because the equipping of a contract with proper plant and tools in first class running order is an obligation of the employer, and it is obvious that it will be very much more difficult to interest the job organization in safety work if the job organization is asked to use defective equipment.

Construction work requires the use of such a wide variety of equipment that this element in accident prevention requires most extensive and careful study. The industrial codes of the various states properly specify the general result to be obtained and certain minimum requirements in special cases. It is, therefore, properly left to the construction industry to develop details in its equipment which will meet the requirements of the codes and the construction industry should feel a responsibility to carry the study of safe plant and equipment beyond the requirements of the codes.

The General Builders Association of Detroit developed a safety code for construction work in 1921, and the National Safety Council has issued a tentative draft of a safety code for construction work. It must be kept in mind however that in building a derrick, hanging scaffold, or other pieces of equipment, it is necessary to have working drawings and therefore it is to be hoped that associations of constructors will co-operate in developing detailed drawings of equipment for general use in the industry.

When a construction organization designs a piece of equipment, it is necessary to secure the close co-operation of the plant engineer who will design and build it, and of the construction department which will use it, and in the design the safety factor must have the most careful consideration and the details used must be such as are most likely to prevent accidents.

Swinging Scaffold

Take for example such a simple piece of equipment as a swinging scaffold, sometimes called a painter's scaffold. The code requires a guard rail along the outside edge. The plant engineer and construction department should carefully consider if it is not practicable to add a guard rail along the inside edge as shown on page 108 of the very useful book on *Safety in Building Construction, Second Edition*, issued by the Travelers' Insurance Co. The use of a guard rail along the inside would help to prevent accidents due to the swaying of the scaffold from the building when the men using the scaffold have neglected to secure it against swaying.

A problem of this kind requires the trying out of such a detail on actual work to find out if it is practicable, and also if it is safer than the single rail, for sometimes devices that on paper look as though they should help to prevent accidents, when put in operation, cause accidents to happen in some other way.

In designing the scaffold it is necessary to decide whether to suspend it with manila rope or wire rope. Many problems of detail must be studied. How should tendency to rot be minimized where rungs are fitted into side pieces if the ladder type of platform is used; is it desirable to truss the platform with wire rope trusses provided with turnbuckles, etc.?

Special Equipment

The swinging scaffold is used as an example of very simple piece of equipment. When it comes to detailing special derricks, spouting equipment and other complicated items of plant, the problem is much more complex, Mr. Dixon states, and in order to secure a careful study of each division of equipment each plant classification is assigned to one of the company's general superintendents for special study with the plant engineer, their recommendations to be approved by the general committee.

Extensive study of the safety element in the design of plant and tools is necessary by individual companies and a great field is open through the National Safety Council for the interchange of ideas and eventually for the publication of working drawings for general circulation. In purchasing plant from manufacturers care must be taken to check the details to make sure that gears and other movable parts are properly guarded and that the design is otherwise correct from a safety standpoint.

Statistics

Proper statistics on the frequency, severity and causes of accidents are of vital importance in helping to secure the interest of the entire organization and also in indicating what operations are causing accidents. It is very important that these statistics shall be kept strictly in accordance with the standard method adopted by the National Safety Council, because in this way each company can compare its experience with the general experience of the industry and a valuable fund of general experience is developed. The detailed method is fully described in the proceedings of the National Safety Council. In general it is as follows:

1. *Accident Frequency*—The accident frequency is the number of accidents resulting in lost time beyond the day on which the accident happens per 1,000,000 man hours worked. For example, twenty-three members of the Construction Section of the National Safety Council report an average accident frequency rate of 59 accidents for each 1,000,000 man hours worked in the year 1924.

2. *Accident Severity*—The accident severity is the number of *days* lost per 1,000 man *hours* worked. If the lost time due to an accident has not been determined when the report is made out, then the approximate time that will be lost is estimated. In cases of death, permanent total disability or permanent partial disability, the lost time is taken from a table—for example; death is counted as 6,000 days, loss of leg above knee as 4,500 days, etc. The twenty-three contractors mentioned in the previous paragraph reported an average severity rate of 4.6 days lost through accidents for each 1,000 man hours worked in 1924. The total of 4.6 days is made up as follows—3.5 days due to the allowance of 6,000 days for each death or permanent total disability, 0.3 days due to permanent partial disability and 0.8 days due to temporary disability. In other words, each man working a full year averaged a loss of two days due to injuries which did not result in death or permanent total or partial disability.

3. *Causes of Accidents*—Each accident is classified as to cause in accordance with a standard list of causes. Here each company should make a most careful study of the exact cause of each accident. The general classification may show the cause of the accident as due to a fall, but a detail study of the accident may show that the fall was due to the fact that the man had taken hold of one of the 4 x 6 vertical pieces used for keeping the tops of the forms for reinforced concrete columns from springing out under pressure of the concrete. These pieces take no side thrust and, therefore, the 4 x 6 was not secured against turning sideways. When the man took hold of the 4 x 6 it turned under his weight and he was thrown to the ground. Such a study leads to the conclusion that an attempt should be made to secure such pieces against turning sideways because any rule prohibiting men from taking hold of such pieces could not be enforced.

Safety Work on the Job

The responsibility for preventing accidents on the job is divided between the employer and the workmen, but the employer and his representation, through superintendents and foremen, have to take the responsibility of trying to secure co-operation from the workmen. The following matters should have consideration:

1. In planning the work the general superintendent and superintendent should keep the safety element constantly in mind. If two practicable methods for doing a piece of work are available they should adopt the safer.

2. The superintendent should keep the element of safety constantly in the minds of his foremen and the foremen, by their example and influence, should educate the workmen under them to use reasonable care in performing their duties.

Foremen should explain to new men any special hazards connected with the work they are to do. Foremen should insist that the workmen must exercise care to avoid unnecessary risks, and if a man persists in a careless attitude he should be discharged.

When a workman receives a slight scratch or cut, his foreman should see that he has it treated at once. Our records do not show a case of a slight cut or scratch disinfected at once, which later caused serious trouble, while such slight cases when not treated until later have resulted in blood poison. In one case the loss of a hand was only averted by surgical work continued for weeks. Foremen should see that workmen wear stout shoes.

3. Warning signs should be used in special cases, as for example a sign on each platform hoist reading "No one permitted to ride on this hoist."

4. Bulletin boards should be placed on each job in a conspicuous place to display the bulletins issued by the National Safety Council and by other organizations. We and other companies should actively co-operate in securing photographs of causes of accidents and other suitable material for the use of this service.

As near as possible to the first of each month each job should be given a statement of the frequency rate of accidents on the job during the previous month accompanied by a statement of the frequency rate for the whole company for the same month and for the preceding 12 months.

Platform Elevators

In his paper, Mr. Doe points out that the platform elevator, commonly called the platform hoist, takes a heavy toll each year in killed and seriously injured workmen. He describes some of the reasons for such accidents and suggests methods to be used to reduce their frequency. In a study of accident prevention he has found that no operation connected with the construction of buildings requires more careful attention. One or more of these hoists are used on the great majority of buildings and the accidents resulting from their use are frequently of a very serious nature. The study is confined to accidents which occur when adequate equipment has been installed, it being assumed that the hoisting engine is in good repair and that the guides and sheaves are properly secured in place.

The description of the system of control in ordinary use at this time by the Turner Company is repeated for the benefit of those not entirely familiar with the operation of the hoists now in use.

Usually two gangs of workmen are employed in hoisting materials, one at the ground loading the materials, the other gang unloading from the hoist at an upper floor, and distributing on the floor as needed. Usually the materials, such as brick and mortar, are placed in two wheelbarrows which are run onto the platform hoist at the ground, raised to the proper story, removed from the car, and their places filled by two empty barrows which are returned to the ground. The hoisting engine is generally so located that it is impossible for the engineer to see the car as it travels up and down the shaft. To bring his car to the proper floor levels he usually places marks on the cable, and drum, after a trial run has been made. A gong placed near the engineer which can be rung by pulling a cord that runs the entire length of the hoist tower is commonly used to give the engineer signals to either raise or lower the platform. Two bells to raise, three to lower and one to stop. Before beginning work the man in charge of the hoist tells the engineer to which floor the material will be hoisted, and makes sure that the engineer's marks are correct by noting the position at which he stops the first load of material. The man in charge who gives signals then remains at the floor where the unloading is being done, usually removing the first wheelbarrow, and replacing the last empty barrow.

Speed Is Essential

In tall buildings speed is essential with these machines. A hoisting speed of 600 ft. per minute is common and a speed of 800 ft. per minute or more is not unusual. The platform hoist is lowered at a much greater speed. If a workman puts a part of his body into the shaft he is hit before he realizes the cage is near him. When he looks into the shaft there is no visible sign of danger, but in a second of time he is killed or seriously maimed. When a man knows he is in danger he is likely to use care, but when the danger is not clearly before his eyes he grows careless. This trait of human nature causes many accidents and especially so in the operation of platform hoists. It can be overcome only by education of the workman as to the potential dangers of his work, and by persistent effort on the part of foremen through warning workman and even discharging them if they persist in careless attitude.

What Usually Happens

On a job where the rule that no man shall ride in a material platform hoist is enforced, and it should be absolutely enforced on every job without any exception being made, the principal causes for accidents may be divided into three classes:

Class A: An employe is struck by the moving car. This happens when someone carelessly leans against the tower, putting an arm or foot through it, or deliberately violates orders and climbs up or down the tower frame, but the most common form of this accident is when an employee who may wish to hoist material steps to the edge of the hoist landing and needlessly looks down and then up the tower to see where the car may be located. This practice is extremely dangerous and has caused a number of serious accidents. It is entirely unnecessary, for the presence or absence of the hoisting cable indicates plainly the position of car below or above the landing. Whether the cable is up or down can be readily determined without peering over the edge of the shaftway.

Class B: Proper safeguards are not placed at the car landings or the ones in place are removed and the openings left in an unguarded condition, permitting an employee to fall down the shaftway if he trips or walks into the opening.

Class C: Improper or untimely signals may be given, causing the car to move up or down contrary to the expectations of those working on it. This type of accident may happen from several causes, such as the failure of the man in charge to give the proper signal to the engineer, or a wrong understanding of the signal by the engineer. The usual cause of this form of accident, however, is due to interference with the signal system by some party other than the authorized signal man in charge of the car. This class of accident is usually apt to prove serious, as those working on the car have practically no warning that it is going to move, and may be caught between the car and the braces, or thrown down the shaftway.

To reduce accidents coming under Classes A and B, it is first necessary to protect the hoist openings as required by Rule 1237 of the *Industrial Code of The State of New York* as follows:

Rule No. 1237—Two sides of all material hoist shaftways shall be enclosed at each floor to the height of not less than eight (8) feet, with wire netting of not less than No. 10 U. S. standard gauge and with not more than one and one-half (1½) inch mesh. Such wire netting shall be secured to uprights so spaced as to afford a strong and substantial guard. Wood slats laid horizontally may be used instead of wire netting, openings between slats not to exceed one and one-half (1½) inches. The guard shall extend two (2) feet beyond each side of the shaftway. At the two sides of hoistway used for handling materials, there shall be adjustable bars three (3) feet high bolted at one end to the guard and placed not less than two (2) feet from the edge of the shaft opening. Such bars shall not be less than two (2) inches by three (3) inches, made of spruce or other approved material of equal strength. A standard toeboard shall be installed on sides not used for handling material of not less than ⅞ in. x 6 in. material.

A Guarded Shaft

The above rule if fully lived up to creates a very effective and satisfactory guard at all hoist openings. Owing to the very heavy type of wire mesh called for by these regulations it is usually more economical to use boards spaced within 1½ in. on the two sides which are not used for loading or unloading. Wherever the handling of material is done on one side only, all of the other sides should be fully boarded in. Fig. 1 is an isometric view of a guarded opening.

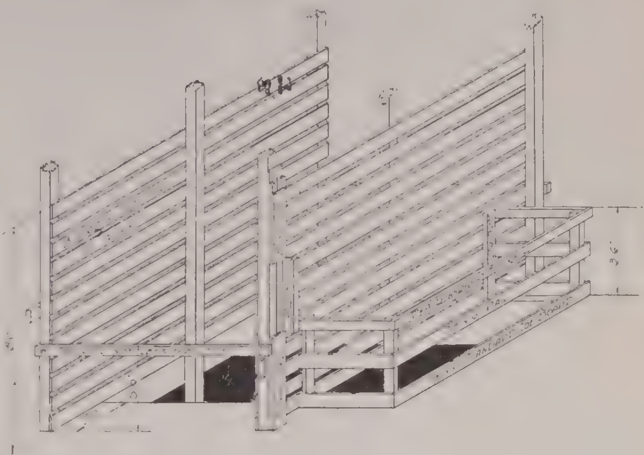


Fig. 1—Isometric view of properly protected material platform hoist landing, located in interior shaftway. Note that balance of shaftway is protected with standard railings, that signal bell cord is boxed in and, a standard railing, or substantial plank floor, protect all portions of shaftway not required by the platform car.—Courtesy Turner Constructor.

With shafts properly guarded, accidents will be frequent, however, unless the superintendent takes steps to see that the adjustable bars, which should always be bolted at one end to prevent removal, are kept in place across all runways to the shaft which are not in actual use and unless the superintendent and foremen insist on the exercise of care by all workmen. As already pointed out, the danger existing at a hoistway is not fully apparent and, therefore, it is only by special effort through education by bulletins and even more efficiently through the example and advice of the foremen that men can be made to realize the hazard that does exist.

In order to try to obtain the most effective method for reducing the accidents coming under Class C, namely those caused by improper signals, the Turner Company sent a circular letter to its superintendents asking their advice and suggestions. Several very interesting suggestions were received, all emphasizing the importance of one-man control of material hoist. One-man control is ordinarily understood to mean that a designated man will be given full charge of the hoist, and will give all signals to raise or lower the car from any floor, excepting the main loading floor. On the main loading floor, when material is being hoisted as fast as possible, the man in charge of the loading usually gives the signal to the engineer to raise each load as soon as it is properly placed on the platform.

Of all the schemes suggested for giving one man complete control, the method used by Olaf Johnson on a hoist at the Merchants Refrigerating Co. building appeared to have the greatest merit and is described by Mr. Doe as follows:

(Concluded Next Month)

The so-called Callahan patent for distributing concrete by means of an elevator and movable pipes directed from above, was held to be invalid for want of novelty and invention, in a decision by the United States Supreme Court, on November 16, in Concrete Appliances Company vs. John E. Gomery.

Concrete Products Must Be Sold in 1926

Problems of Industry No Longer Those of Production—Future Development of Industry Depends Upon Salesmanship—Plants Must Maintain Maximum Output to Insure Maximum Profit

Not very long ago a man who was planning to establish a block plant went to a friend of his for some advice on equipment. The friend was a good engineer who knew from experience what was needed in a block plant, and the man depended on his friend's judgment to determine what machine he should buy first. But the advice he received proved a surprise to him. When he asked what machine he should buy first, his friend said, "Buy a Ford."

A little conversation developed the fact that the idea back of this advice was simply that selling the product of a block plant is a bigger problem than that of production. Viewed in that light, it was easy for the man to see why his decision to purchase a Ford which would enable him to cover his territory economically, was just as important as his decision as to just what type of block making equipment he should install first.

As a matter of fact the concrete products industry has grown at an amazing rate, and it is not surprising that under these conditions most block makers have regarded their major problem as that of production. Five years ago only about one million barrels of cement went into the annual production of concrete building block and tile. In the year 1925, however, about twelve million barrels of cement will have been used in making concrete building units. Other branches of the concrete products industry have grown almost as fast, and for the year 1925 there was used in the neighborhood fourteen million barrels of cement in products other than wall units. When you stop to consider that nearly twenty-six million barrels of cement went into concrete products in the last year, and that the wall volume of concrete building units produced during that time exceeded the wall volume of the brick industry for 1924, it is plain that someone has been giving a good deal of attention to the production problems of the industry.

This enormous increase in production has not been shared by everyone engaged in the business, however. Some firms have gone ahead at an unusually rapid rate. Others have not made progress that is at all comparable to that of the industry as a whole. But the facts of the situation—a twenty-five per cent annual increase for the last few years—furnish a standard by which the individual producer may measure his own progress. If he has exceeded the average he may consider himself one of the real leaders of the field. If he has equalled the average he has no cause for discouragement. But the man who has fallen behind the average rate of growth should examine his position very carefully. He should ask himself whether or not there are any special reasons to account for his falling behind the pace that the industry as a whole is setting, and if he finds no legitimate cause for his failure to meet the standard, he should see to it that his methods of merchandising his product are improved to the point where they will provide an outlet for a properly and continuously increasing volume of production.

Just here we touch upon the real problem of the concrete products industry for the next few years. Problems of production have been to a large extent solved. Plenty of machinery is available today that will make good blocks, and make them in profitable quantities. It may truthfully be said that it is no longer a problem to make more good blocks than you can sell. But unfortunately there are not many product manufacturers who are awake to the need of modern selling methods in their business, and unless that need is realized there are many men making concrete blocks today who are going to have great difficulty in keeping pace with the industry to which they belong, and in meeting the competition of other building materials.

When concrete wall units first began to be placed on the market they were sold largely for use in the building of garages, small shops, foundations and other concealed or minor structures. The expansion of the market to the present time has been largely in these directions, but the point has now been reached where further expansion must include types of buildings in which concrete products have not been particularly favored.

It is an unfortunate fact that the public knows very little about the real advantages to be gained by the use of concrete wall units in ordinary buildings. Owing to the very small amount of sales work that has been done by concrete products manufacturers the average builder is totally uneducated as to the possibilities of concrete block and tile construction. This is a condition which must be changed, and about the only way in which it can be changed in the near future is by the spreading of the facts about the economies, conveniences and beautiful effects to be gained by the use of concrete products. This must be done by the manufacturers of the products themselves. In other words the men who make the block and tile must go out and tell the building public why they should buy it in preference to other building materials.

Those who have not had opportunity to observe the result of an industry-wide sales campaign can scarcely appreciate what a little concerted selling will do. Many examples might be cited from other fields that show pretty conclusively just how the thing works out. Take the automobile accessory field for instance. Five years ago they thought that they had a pretty good turnover. Any outsider—and many an insider—probably would have considered it a mighty good business. And then someone came along who suggested that they "ask 'em to buy." They tried it. Accessory sales began to jump at an unheard of rate. And now they don't think business was so good five years ago after all.

Right in our own field, the Portland cement industry furnishes another example. Portland cement manufacturers decided a long time ago that if they wanted their industry to reach its maximum development they must "ask 'em to buy" on a big scale, and see to it that everybody knew as much as possible about the many ways in which their product was particularly useful. The result is a production curve that goes up, and keeps going up pretty much regardless of business conditions. All this is an old story, of course, and familiar to most of our readers, but it still has its moral for the men who are using that same cement to create products which present sales problems that are today becoming just as urgent as any that the cement manufacturers ever had to solve.

The concrete products industry today has reached a point where some clear thinking is necessary. Production has been increased at a rate that has more than met the need of the so-called "natural" market. Plenty of good high speed machinery is in operation throughout the country, and some of it is beginning to be idle a good deal of the time. Many plants are going along operating at three-fourths to one-half or even a smaller fraction of their maximum capacity. It is quite true, of course, that some money is being made by many plants operating under these conditions; but it is just as true that nothing like the maximum profit can be realized on a plant that is operated at only a fraction of its maximum capacity, and unless the condition is remedied, competition among products makers is certain sooner or later to affect prices in a way that will make it increasingly difficult for part time producers to realize anything on their capital. Any man who is operating a products plant today at less than capacity is facing a very certain and definite danger, and he should not blind himself to it.

The remedy for this situation is to be found in intensive merchandising. Men who make concrete products would do well to leave much of the supervision of their plants in the hands of capable foremen, and spend their own time in the field seeing to it that their products get a fair hearing on every building project that comes up.

There is no question but what concrete wall units fail to go into many structures simply because there is no one to point out to the man who is responsible for the building the advantages that he can gain by using concrete products. The builder always knows all the bad things that have ever been said about concrete blocks, but only too seldom does he know the good things that ought to be said, and—unfortunately—are not being said by the very men who make those blocks.

This condition represents a very real and immediate danger to the concrete products industry, and it is a danger that cannot be met by anyone but the manufacturers themselves.

Some concrete products men are waking up. Some of them are doing more than that—they are achieving remarkable success in the field of practical selling. But there are not enough of that kind of men in the business, and unless more block producers wake up to the true situation during the coming year it scarcely seems possible that the industry will continue to go forward at the rate that has marked its progress for the last five years.

We believe that the true interests of the concrete products industry can best be served by the development of a sane merchandising program—one that the average block maker, wherever he is, can make part of his own business practice. This can be best accomplished if concrete products manufacturers will regard themselves as one large association, banded together for their mutual welfare, and ready to learn all that they can from each other about the best ways in which to sell their products to the public. To that end we invite any manufacturer who has had particular success in the merchandising field to use our columns to pass on his experience to the other men in the industry. And if there are among our readers those who are awake to the necessity of the situation, but seriously in doubt as to what steps to take in order to most effectively meet their own problems, we will be glad to give them any help that we can.

Recent Appointments in the Highway Research Board

Announcement is made by Director Charles M. Upham, Highway Research Board of the National Research Council, that Professor S. S. Steinberg of the University of Maryland has been appointed Assistant Director of the Board. He will also for the present continue to serve as Acting Secretary of the Investigation on the Development of Earth Roads now being conducted under the auspices of the Highway Research Board. Professor Steinberg served as Assistant Director during the summer of 1924.

H. F. Janda, former Assistant Director, has been designated Secretary to Research Committees in accordance with the new policy of the Board to employ technical assistants who shall devote full time to research committee work. Professor Janda will return to his duties at the University of North Carolina on January 1, 1926, at the expiration of his leave of absence.

New Building Material Developed in England

A new building material, which it is claimed will reduce the cost of house building by 20 percent, has been developed in England, says a report from the Consulate at London. The material, which is called "Factocrete," is described as being a cross between concrete and wood, being as durable and as easily moulded or cast as the former, and as easily sawn, nailed, screwed and polished as wood.

It is made in two varieties, water-resisting and absorbent, so that it may be used for both outside and inside walls and fittings of a house.

By the use of this material in units it is claimed that a house can be erected with the aid of 20 percent skilled and 80 percent unskilled labor in from 12 to 16 days. The units can be adapted to any type of house, so avoiding a stereotyped appearance.

Milwaukee Crane Reorganized as Wisconsin Corporation

The Miiwaukee Electric Crane & Mfg. Co., Inc., which was a New York Corporation doing business at Milwaukee, manufacturing Overhead Electric Traveling Cranes, Monorail Hoists and Lumber Handling Cranes, has been reorganized under the laws of the State of Wisconsin as the Milwaukee Electric Crane & Manufacturing Corporation, with an increase of capital stock from $300,000 to $400,000 preferred stock and from 7,000 shares to 8,000 shares of common no-par value stock.

The Wisconsin Corporation has acquired all of the property and business of its predecessor, which represents upwards of One Million Dollars in real and personal property. The new company is preparing to largely increase its business and extend its field of operations.

The officers of the new Corporation are as follows:

M. A. Beck, President; Henry S. Wright, Vice-President; A. J. Pitman, Vice-President M. P. O'Brien, Secretary-Treasurer.

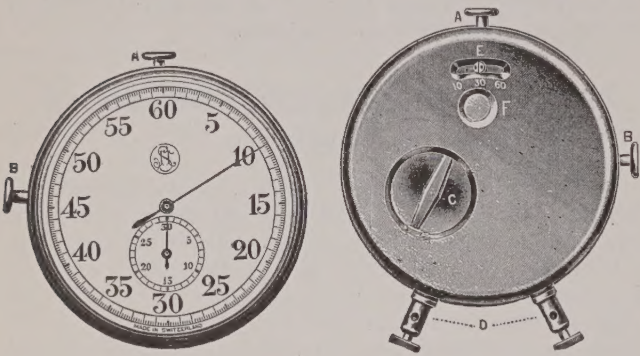
The above men with the addition of Henry M. Thompson widely known capitalist compose the Board of Directors.

The Annual State Convention of the Ohio Concrete Products Association will be held in Toledo, Ohio, on January 12, 13 and 14.

New Equipment

A Handy Stop Watch for the Job or Laboratory

Timing the mix is important. It is just as important to time every other operation on the job, for on the basis of time rests not only the quality of the concrete, but the determination of the efficiency of man and machine and the figuring of unit costs as well. Often a reliable stop watch is of value to the contractor and the engineer on the job or in the laboratory.



The New Stop Watch recently introduced.

A new stop watch that seems adaptable to this type of service has recently been introduced by the O. Zernickow Co., 15 Park Row, New York City, illustrated herewith. It is said to be a precision instrument with a good anti-magnetic movement, with nine jewels, in a stout nickel case, 2½ in. in diameter. The starting and stopping mechanism is a unique patented feature. The starting and stopping is accomplished by pressing the button "A," which works on the principle of a hair trigger, and operates with but little jar to the mechanism. The zero setting device is designed to permit a gradual return of the hand to zero, eliminating the sudden jerks that prove destructive to some other stop watch movements. The running time is 20 hours without rewinding. The dial is graduated to 1/5 second, the large hand making one revolution of the dial in a minute. The small dial and hand registers up to 30 minutes. Decimal and double graduations are furnished to order. An electric type, for special laboratory use, is available.

Magnetic Tests for Wire Rope

A test which could be applied to steel hoisting rope to show whether it is in safe condition or not, and which would not require the cutting of a sample from the rope, would be of great value. Every industry and operation which depends on wire rope for hoisting and haulage purposes is anxious to learn of some method by which the condition of ropes can be determined in service.

For some time the Bureau of Standards has been investigating the possibility of applying some form of magnetic test to wire rope to determine its condition, as it is known that breaks in the individual wires, worn places, etc., as well as the stress on the rope, affect its magnetic permeability. The development of any practicable test is a difficult matter, because of the many variables which must be considered.

In order to design intelligently apparatus for the non-destructive testing of wire rope it is necessary to know the nature and magnitude of the effects involved. One of the causes of deterioration of rope is wear, and the Bureau has recently completed an investigation of the effect of wear on the magnetic properties and tensile strength of steel wire such as is used in the manufacture of wire rope.

The Bureau found that wear increases the magnetic permeability for low magnetizing force, and decreases it for higher values, in other words opposite readings are secured, depending on the magnetizing force employed. A load on the wire produces a similar effect, though it is much less in magnitude, and is probably caused by a redistribution of the internal stress in the wire. This change in magnetic properties is accompanied by an increase in the tensile strength.

The New Lakewood Finisher That Is Now Available to Contractors

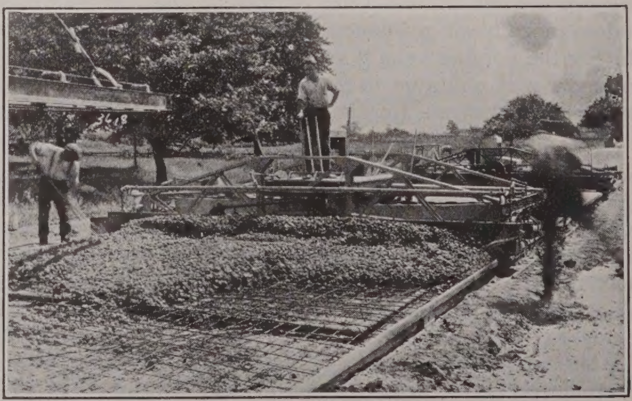
At the Road Show this month, the Lakewood Engineering Company will show their new type "C" Lakewood Finisher, which combines two machines in one, namely a Screed and a Tamper.

For screeding there is provided an all steel strike-off twelve inches wide at the bottom and adjustable for crown. This is driven at about forty-five strokes per minute and spreads and surfaces the concrete.

Following the screed is the tamper which assists in bringing up the necessary mortar for finishing, particularly on dry or coarse aggregate concretes.

At the rear of the machine is the belt float driven with an improved mechanism.

New type channel frame trusses are used. A sliding gear type transmission with heat treated gears running in oil is provided which gives two speeds forward and two reverse.



The new Lakewood Finisher that is appearing at the Road Show this season.

Drive is direct to all four traction wheels through worm gears which are enclosed and run in oil.

Mixer Musings

Reported by "Joe"—The Mixer Boss.

The Foreman Gives His Boss an Earful

"I hear the architect is kicking about the low strength of our test cylinders," remarked the superintendent to the job-ridden contractor, as they hunched about the red-hot stove in the shanty. "His slip-stick expert was just in this morning and said we'd better keep those forms up for another week. 'ell of a note, ain't it."

"Nothing doing. Down they go in the morning," replied his boss, who was busy figuring on the back of a lumber-yard bill with a chewed-off pencil. "I'll be darned if I get another carload of form lumber just to give that rah-rah boy another excuse for holding down his job. Better hustle up on that stripping, so we can get ready for the next pour before another blizzard comes this way."

"Maybe that fellow was right, though," suggested a red-necked fellow who had drifted into the shack during the conversation. "I was talking with him this morning and he told me some surprising things."

"How about it? You're the foreman, and ought to know what you are mixing," the contractor replied to this interruption.

"The weather has been cool, and getting colder," was the rejoinder. "I've been putting through the batches on summer schedule right along, and I know that they look alright. I remember, though, that we had some trouble on a job some years ago, and the engineer told us that the stuff had merely froze up on us. But as I was saying, this inspector fellow was telling me this morning that it doesn't take real freezing weather to kill the job. Just a few cool nights and a little frost, and we must expect to have to slow down, or else buy more tarps and heaters. I misremember the details, but he had a little book, fixed up by some college professor, that had the whole thing done up in a fancy set of curves. Guess he has the right idea after all."

"I don't believe it," barked the boss." I've put up buildings like this for the past fifteen years and never had a smash. A floor a week is my motto, and no mama's boy of an architects' inspector can tell me I can't do it, rain or shine. Look at the cost of the lumber they are sending us today, will you?"

The foreman, all this while, was fishing around in his pockets, getting madder and madder all the time. He'd had one job frozen in a past winter, and he knew how it was to have some of his men caught like rats in a trap when the whole thing came tumbling down on top of them. He had just managed to shin out of the mixer-pit in time, and didn't want the thing to happen again on HIS job, thank you. All at once he stopped his search, and shoved under the contractor's nose a little paper bulletin, marked with the imprint of a famous university laboratory.

"There's your answer," he said. "This is what the inspector showed me today, and left with me to study over. See what you make of it, and then tell me about lumber bills, if you've got the nerve!

The contractor leafed through the booklet, scratched his head over the charts for a time, and then admitted,

"Maybe there is something to it, alright. But how do you explain the fact that it's never acted like that on any of my jobs before?"

"Maybe the factor of safety took care of you," was the foreman's answer. "Don't forget that your concrete must be three times as strong as it has to be, to allow for just such troubles. Maybe your other jobs just got by, and stood up in spite of low strengths. Concrete can be laid anytime if you know how to handle it."

A moment's silence followed. Then the superintendent said, "I guess we'd better leave that lumber up for a little while longer, after all. What about it, boss?"

"You're the doctor, go ahead, but for pete's sake watch your costs," the contractor replied, as he pulled on his coat and went out of the door, carrying the booklet with him.

"Say, Bill, what's the telephone number of that fellow that sells tarps and salamanders," was the only answer the super gave.

Many a pretty surface has been spoiled by a little good steel,—just a little too near the surface. Put it inside, where it can better do its work and not try to break out and run away.

Mr. Municipal Contractor,—don't try to get the inspector's job when he catches you on a boner. Live and let live is a policy that brings down unit costs on any job. Inspectors like to talk.

It may be all in fun, and it may give someone an idea. At least we hope that you will send some thoughts for this page, because no one of us can think of anything about every kind of job. This is a page for the man on the job, and to make celebrated some of the fellows we all see every day, and to pass along food for further thought. Let's swop ideas and let the mixer roll.

Yours till it rains,
Joe, the mixer boss.

Deflection of 40-Inch Wall Under Pressure of Finger Can Be Measured by New Device

The amount of deflection of a masonry wall 40 inches thick under the pressure of one finger can be measured by an instrument recently constructed by C. G. Peters of the Bureau of Standards, Department of Commerce. If one looks into the eyepiece while some one else walks across the floor the deflection is apparently so great that one would suppose the whole building to be swaying back and forth as though made of cardboard.

The instrument makes use of the interference of light waves, and is very simple in construction. A glass plate is fastened to the wall of the building. Another plate is mounted close to this first plate in the tube of the instrument. Part of the light from a helium tube passes through the plate in the instrument and is reflected back by the plate on the wall into the eyepiece. The remainder is reflected directly from the plate in the instrument. The interference of these two sets of light rays causes light and dark bands to appear in the field of the eyepiece. When the distance between the two plates is changed the bands move across the field. Motion equal to the distance between two dark bands represents a deflection of about one one hundred thousandth of an inch.

R. F. Imler, formerly associate editor of *Concrete Products*, and for the last three years with the Thomas W. Noble Company, Chicago, will take charge of the Detroit office of that concern on January 1, and will handle the Universal line of block making equipment.

Trade Publications

"*Hawthorne Roofing Tile*" is described in an interesting booklet just issued by the Hawthorne Roofing Tile Company, 22nd street at 48th avenue, Cicero, Illinois. The literature illustrates the main features of the tile and how it is laid, and contains suggested specifications, laying instructions and working drawings for the convenience of the architect and the builder. The history of the tile is given some attention, and the manufacturing process is briefly described.

Research and its place in industry are discussed in *Co-operative Industrial Research,*" received from the Department of Manufacture, Chamber of Commerce of the United States, Washington, D. C. Single copies will be furnished on request.

Technologic papers of the Bureau of Standards are contained in a recent booklet of the Department of Commerce, Bureau of Standards, Washington, D. C. Tests of hollow tile and concrete slabs reinforced in one direction are principally discussed.

Results of strength tests on mortars for masonry construction cured in warm and cold temperatures, from tests made in the Materials Testing Laboratory of the University of Wisconsin, Madison, are reported in a leaflet of that name issued by the Engineering Society of Wisconsin.

The Concrete Reinforcing Steel Institute has published, in booklet form, the proceedings of the semi-annual meeting of its organization in Chicago September 23rd. Papers on "Economic Aspects of Trade Welfare," and "Tentative Report on Spirals by Committee on Grade of Steel and Standard Sizes" are included among others.

Engineers interested in modern urban garages will find much of import in "*Building Garages for Profitable Operation,*" recently distributed by the Ramp Buildings Corporation, 21 East Fortieth Street, New York City. Following an introduction on city garage requirements, details of the d'Humy Motoramp System of Interfloor Travel are well illustrated and described.

"Iron and Steel," a census of 1923 manufactures and containing chiefly steel works and rolling mill statistics is being distributed by the Superintendent of Documents, Government Printing Office, Washington, D. C.

A recently published four-page leaflet entitled "*Safety in Quarry Blasting,*" by Arthur LaMotte, Manager of the Technical Section, E. I. duPont de Nemours & Company, Wilmington, Delaware, gives much good advice in the use of explosives, cautioning against short circuits and stray currents.

The subject of automatic control and its relationship to efficiency and economy in the operation of industrial plants is extensively treated in *Catalog No. 87* of the Brown Instrument Company, Philadelphia, Pennsylvania. The use of indicating, signalling, recording and alarm instruments in various plants are illustrated and described.

What are said to be the greatest forward steps ever made in Recording Pyrometer design is announced by the Brown Instrument Company, Philadelphia, Pa., in its *Bulletin 1-13*. Several colorful photographs furnish good descriptions of the instruments.

The Pennsylvania Pump and Compressor Company, Easton, Pennsylvania, now has ready for distribution a new *General Products Catalog, No. 125,* designed for the busy executive desiring in concise form, a comprehensive view of this company's products. Illustrations are profuse and clean-cut.

Recently received from the Allis-Chalmers Manufacturing Company, Milwaukee, Wisconsin, is a four-page leaflet, Bulletin No. 1228, relating to roller bearing motors and containing simplified illustrations. A later mail brought Bulletin No. 1823, devoted to crushing rolls of the Garfield type, as well as Bulletin No. 1228, on Texrope drive, a flexible and multiple belt drive for close centers.

The Department of the Interior has just issued a comprehensive report on Colorado River, as a result of engineering studies by the Geological Survey, *known as Water-Supply Paper 556*. The author is E. C. LaRue, hydraulic engineer, who has made a study of the river during the last 15 years, in the course of which he has made boat trips aggregating nearly 2,000 miles along the river and its major tributaries, including the whole of the Grand Canyon.

The Geological Survey report deals with the comprehensive development of Colorado River below the mouth of Green River, with particular reference to flood control and the development of hydroelectric power. Records of stream flow are summarized, and estimates of water supply available at many points under a variety of conditions are presented. The principal reservoir sites are described, and their availability and usefulness are discussed. Plans, cross sections, and area and capacity curves, together with engineering and geologic discussions are presented for all known dam sites on nearly a thousand miles of river, all of which has been surveyed and mapped. In summarizing Mr. LaRue suggests that the scheme of development should be comprehensive and should provide for the maximum practicable utilization of the potential power, the maximum storage of water for irrigation, and above all the effective elimination of the flood menace and an adequate solution of the silt problem. Such a plan, when executed, necessarily covering many years, would in his opinion include the construction of 13 dams, which would make available 3,383 feet of head or fall for the development of power and a maximum of 42,000,000 acre-feet of storage capacity for the control of floods, equalization of flow and storage of silt. Under this plan nearly 6,000,000 acres of land could be irrigated by the waters of Colorado River, 3,420,000 continuous horsepower could be developed in the canyons below the mouth of Green River, and a domestic water supply could be made available for a population of 10,000,000 to 15,000,000 in urban communities of the Southwest.

Organizations

American Concrete Institute; Harvey Whipple, Secretary, 2970 West Grand Blvd., Detroit. Convention, Feb. 23-26, 1926, Hotel Sherman, Chicago, Ill.

American Concrete Pipe Association; M. W. Loving, Secretary, 111 West Washington St., Chicago. Convention, Feb. 22-23, 1926, Hotel Sherman, Chicago, Ill.

American Construction Council; Dwight L. Hoopingarner, Executive, 28 W. 44th St., New York City.

American Engineering Standards Committee; Dr. P. G. Agnew, Secretary, 29 West Thirty-ninth St., New York City.

American Road Builders' Association; Wm. H. Connell, President, Miss E. A. Birchland, Secretary, 29 W. 39th St., New York City. Annual convention and Good Roads Show, Chicago, Jan. 11-15, 1926. Exhibits.

Associated General Contractors of America; D. H. Sawyer Secretary, 1038 Munsey Bldg., Washington, D. C. Next convention January, 1926, Portland, Oregon.

Associated Metal Lath Manufacturers; 123 West Madison St., Chicago; Wharton Clay, Commissioner.

Building Officials Conference; Frank Burton, President, J. F. Downey, City Hall, Cambridge, Mass., Secretary.

Concrete Reinforcing Steel Institute; M. A. Beeman, Secretary, 160 North La Salle St., Chicago. Annual meeting, March, 1926, Atlantic City, N. J. Date not selected. No exhibits.

Concrete Products Association; W. H. Carey, President, Bert Carey, Secretary, 111 W. Washington St., Chicago, Ill. Next convention, Feb. 25-26, 1926, Hotel Sherman, Chicago, Ill.

Mid-West Concrete Products Association; D. R. Donlen, Secretary-Treasurer, 4340 Marcy St., Omaha, Neb.

Ohio Concrete Products Association; G. M. Friel, Secretary-Treasurer, 2284 North High St., Columbus, Ohio.

National Association of Building Trades Employers; A. E. Coleman, President, 37th St. & Stewart Ave., Chicago. A. W. Dickson, Executive Secretary, 214 Electric Bldg., Cleveland, Ohio.

National Association of Builders' Exchanges; William F. Chew, Baltimore, President; Earl F. Stokes, Secretary, 15 East Fayette St., Baltimore, Md.

National Crushed Stone Association; A. P. Sandles, Secretary, 405 Hartman Bldg., Columbus, Ohio.

National Housing Association; Lawrence Veiller, Secretary and Director, 105 East Twenty-second St., New York City.

National Sand and Gravel Association; T. R. Barrows, 903 Munsey Bldg., Washington, D. C., Secretary.

The National Lime Association; Burton A. Ford, Secretary, 918 G. Street, N. W., Washington, D. C.

Portland Cement Association; William M. Kinney, General Manager, 111 West Washington St., Chicago.

Wisconsin Concrete Products Association; D. R. Collins, Secretary-Treasurer, 425 E. Water Street, Milwaukee.